

Selected geographical issues in the global listed equity market

Analysis for the Norwegian Ministry of Finance

October 2019



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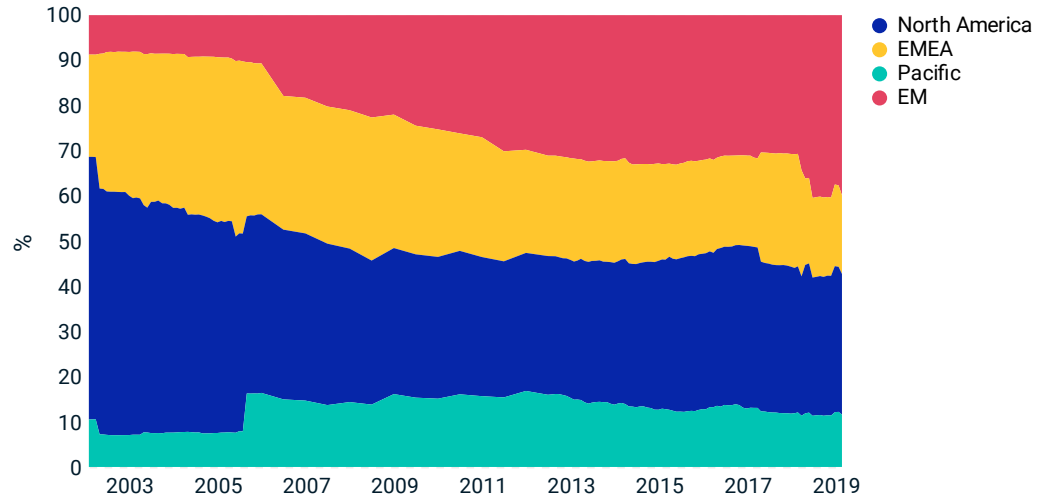
Executive summary

This report summarizes the findings of research MSCI performed as part of the mandate defined by the Ministry of Finance of Norway, as described in the Appendix. Global markets have become increasingly interconnected over time due to more cross-regional economic activity and investment during the past two decades. This makes the identification of risks more complex. For instance, even companies that have all their production within Developed Markets may have a significant economic exposure to Emerging Markets from their trading or investment activities.

Consequently, understanding the development of cross-regional market correlations has become increasingly important for diversifying risks in a global asset portfolio. The purpose of this research report is to address these challenges by assessing the long-term risk and return drivers of global equity markets, and their regional differences. In addition, we tested different ways to benchmark global equity markets by using and simulating various regional weighting schemes and comparing them to GPF's current benchmark. A key focus of this comparison was understanding how to diversify financial risks effectively across global regions. Consequently, this report seeks to derive key insights that may be of relevance when defining GPF's regional asset allocation and constructing a corresponding global equity benchmark. The report also assesses the role of Emerging Markets in growing the global opportunity set and how this may affect a global benchmark going forward.

The purpose of the analysis in **section one** is to understand how global economic trends such as the growth of Emerging Markets affected the global equity opportunity set and the asset allocation of institutional asset owners globally. To start with, we provide a trend analysis of global economic activity and global trade. We see that economic growth stabilized after the financial crisis (from end of 2010 to end of February 2019) with a clear growth advantage of 2-3% for Emerging Markets (EM) versus Developed Markets (DM). At the same time, the global trade to GDP ratio grew and corporate sales became more global. Emerging Markets' share of global sales revenues grew at an even faster pace than their share of global GDP (Exhibit 1), providing evidence for a shift from an export-led economic growth model to a demand-driven growth model in Emerging Markets.

Exhibit 1: Regional distribution of global corporate sales revenues



Source: MSCI. Data from Jan. 31, 2002 to Feb. 28, 2019.

The growing role of Emerging Markets in the period 2003 – 2018 was mirrored by the increasing number of listed securities from EM in the global benchmark (MSCI ACWI IMI). The increasing weight of EM in the global benchmark was mainly driven by the inclusion of additional Emerging Markets into the benchmark. However, EM’s share in the global equity opportunity set still lagged behind its economic weight in terms of total market capitalization,¹ and even more in terms of free-float market capitalization.²

In parallel, investors in equity markets became increasingly global and interconnected, as witnessed by the decline in asset owners’ home bias: institutional investors increasingly moved from an asset allocation strategy that was focused on their home market toward a global asset allocation strategy.

Section two looks at correlations and diversification across regions to understand the drivers for diversification benefits in a global asset portfolio. We first verified that North America, EMEA (Europe and Middle East), Pacific and Emerging Markets are meaningful building blocks for defining a regional asset allocation: These regions were found to be natural correlation clusters in global equity markets. Although average inter-regional equity correlations between the four main regions North America, Europe and Middle East, Pacific and EM have increased over recent

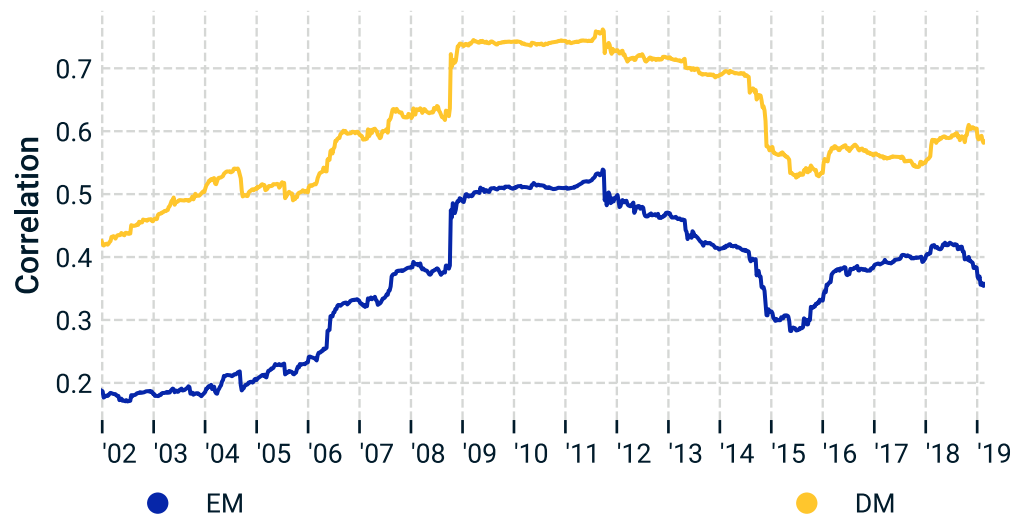
¹ The total market capitalization of a stock is its price times the number of outstanding shares.

² The free-float adjusted market capitalization of a stock is the part of total market capitalization that excludes closely held shares. It is calculated by multiplying the total market capitalization of a stock by the foreign inclusion factor (which measures the proportion of shares available to foreign investors).

decades, we observed a clear benefit from diversification across regions and from adding EM exposure in a global equity portfolio.

While diversification across regions and sectors was important, the most important driver for diversification was the number of securities in the global benchmark. Country correlations in Emerging Markets were on average lower than in Developed Markets (Exhibit 2) and country diversification benefits in Emerging Markets were more significant than in Developed Markets.

Exhibit 2: Average pairwise country correlation in DM and EM



Source: MSCI. Data from Dec. 28, 2001 to Feb. 28, 2019.

We observed that concentration risks³ in global equity portfolios increased over the past decade, both at a country level due to the dominant role of U.S. equity markets in DM and China’s dominance in EM, and at a security level due to the rise of so-called mega-caps, i.e., FAANG⁴ and BAT⁵ stocks. We found that the market capitalization of the biggest of these companies surpassed the GDP of Norway and

³ We define concentration risk as the risk of a large weight in a portfolio to be exposed to a single source of risk. For instance, a large weight of a country in a portfolio exposes the investor to the political risk of the country.

⁴ FAANG stands for Facebook, Amazon, Apple, Netflix and Google.

⁵ BAT stands for Baidu, Alibaba and Tencent.

that they became increasingly inter-correlated, potentially making them a risk factor that global investors should reckon with.

Concentration risk is an important risk dimension for long term investors. Mitigating concentration risks (i.e., reducing or limiting the weight of the respective exposure in the investor's portfolio) can be important for limiting institutional investors' exposure to potential regional bubbles in equity markets (such as the bubble in the Japanese equity market in the 1980s) and in averaging out regional differences in fundamental long-term performance trajectories. Going forward, global investors face the risk that Emerging Markets' growth trajectory may falter and the risk of a reversal in the U.S. equity market, which now accounts for almost 60% of global market capitalization. The risk of a reversal of the U.S. equity market is based on the observation that its better financial performance compared to other regions over the past decade was not uniform but driven by just a few sectors – mainly Information Technology. In brief, finding an effective way to diversify risks across global regions in the weighting scheme of an institutional investor's portfolio is essential for addressing concentration risks, differences in growth trajectories and differences in sector performance.

The analysis in section two shows that a broad geographical capital allocation helped to diversify concentration risks. At the same time, monitoring concentration risks at a country, sector and stock level (mega-caps) became increasingly important.

In the **third section**, we review the historical performance of Developed Markets, Emerging Markets and the four regional equity markets (North America, EMEA, Pacific and Emerging Markets) in terms of their free-float adjusted market capitalization and fundamental performance drivers. From the launch of the MSCI Emerging Markets Index in 1987 until the end of February 2019, Emerging Markets outperformed Developed Markets (MSCI World Index) and the global benchmark (MSCI ACWI) as shown in Exhibit 3, albeit with higher levels of financial risk (volatility, Value-at-Risk and drawdowns).

Exhibit 3: Performance and risk overview of Developed and Emerging Markets

Metrics	ACWI	World	EM
Full period return (%)	7.8	7.8	10.7
5 Yr (%)	6.9	7.1	4.5
10 Yr (%)	13.3	13.7	10.7
Sharpe ratio	0.29	0.29	0.32
Volatility	14.8	14.6	22.5
VaR @ 99%	-10.6	-10.6	-15.7
CVaR @ 99%	-14.3	-13.8	-22.5
Max drawdown (%)	-54.6	-53.7	-61.4

Source: MSCI. Data from Dec. 31, 1987 to Feb. 28, 2019. Performance is annualized.

In addition, we observed significant performance differences across Developed Markets regions (Exhibit 4): North America's performance of 10.4% p.a. (per annum) was close to Emerging Markets' performance of 10.7% p.a., but with significantly lower levels of risk. Therefore, risk-adjusted returns (Sharpe-ratio) were highest in North America. Financial performance was lower in EMEA (Europe and Middle East) and lowest in the Pacific region, mainly due to the sluggish stock market of Japan.

Exhibit 4: Performance and risk overview of four regions

Metrics	ACWI	North America	EMEA	Pacific	EM
Full period return (%)	7.8	10.4	8.1	2.9	10.7
5 Yr (%)	6.9	10.0	1.3	5.1	4.5
10 Yr (%)	13.3	16.1	10.3	9.8	10.7
Sharpe ratio	0.287	0.486	0.271	-0.034	0.318
Volatility	14.8	14.2	17.0	18.9	22.5
VaR @ 99%	-10.6	-9.7	-12.2	-13.3	-15.7
CVaR @ 99%	-14.3	-13.4	-15.5	-16.4	-22.5
Max drawdown (%)	-54.6	-51.1	-59.0	-52.2	-61.4

Source: MSCI. Data from Dec. 3, 1987 to Feb. 28, 2019. Performance is annualized.

Although short term inter-regional equity correlations were relatively high (section two), long-term profitability (return on equity) trends and changes in relative valuation were substantially different across regions and were the key driver in explaining differences in regional stock performance.

Some key findings are worth mentioning: The strong performance of North America during the past 25 years was reflected in slightly higher earnings growth of 3.2% p.a. (compared to 2.7% p.a. at a global level) and a stronger expansion in valuation levels compared to other regions. North America also showed the highest average level of profitability. However, we found that profitability and valuation became increasingly uneven in North America, with the Consumer Discretionary, Consumer Staples and especially the Information Technology sector at the upper end of the scale for return on equity.

In Emerging Markets, earnings growth was only slightly higher than in DM, despite much higher GDP growth rates. Profitability in EM (measured as RoE) had reached similar levels as in DM as of February 2019. In EMEA, earnings growth at 1.1% p.a. clearly lagged behind the global level (MSCI ACWI), but investors profited from higher dividend yields. The underperformance of Pacific during the study period was explained by a large decline in valuation levels, even though earnings growth at 4.6% p.a. was above the global level of 2.7% p.a. The main driver for falling valuation levels in the Pacific region was the Japanese equity market. In brief, the four regions showed very different profitability and earnings growth trends during the 25-year study period and geographical diversification helped to diversify regional differences in risk and performance during this period.

In addition, we found that countries in EM showed higher average equity risk premia than countries in DM, which we were able to explain (using regression analysis) by differences in the size, liquidity and country risk (as measured by the World Bank Governance score⁶) of countries. We found no strong historical relationship between stock performance at a country level on the one hand and GDP growth or earnings growth on the other hand. We also saw that stocks in DM with high sales exposure to EM showed a high level of stock correlation to EM equities. In addition, during the past decade companies in Europe and Pacific with economic exposure to Emerging Markets outperformed their regional peers.

Dispersion in stock performance and GDP growth across countries were higher in EM than in DM, which made risk diversification even more important in EM than in DM.

In brief, our analysis of Emerging Markets showed the importance of diversification across EM countries. We also found evidence that historically risk premia were higher in smaller, less liquid EM markets with higher levels of country risk.

In **section four**, we look at the results of historical and fundamental stress tests for global and regional markets. Applying historical stress scenarios to current benchmarks confirmed how inter-connected regional markets were and how crisis situations may spread across regions. The purpose of fundamental stress tests is to go beyond the simulation of historical scenarios to simulate potential fundamental downside trajectories for markets, such as seen in Japan over the past three decades. The key finding is that in such fundamental downside trajectories the potential financial loss clearly exceeds losses seen in historical stress tests.

In brief, the key finding of section three and four is that long-term fundamental growth trajectories (and potential stress trajectory) of regional markets can be very different and are impossible to predict. Therefore, geographical diversification may reduce the risk of being over-exposed to regional bubbles.

In **section five**, we tested and compared different alternative regional weighting approaches using standard benchmarks to represent each region. We compared these alternative weighting schemes to four benchmarks: Free-float market cap weighting (MSCI ACWI), Total market cap weighting (MSCI ACWI Total Market cap), Total Market cap weighting focused on Developed Markets only (MSCI World Total market cap) and GPF's current regional weighting scheme, which over-weighted Europe compared to MSCI ACWI.

⁶ We use the average of the Worldwide governance indicators (WGI): Voice and Accountability, Political Stability and Absence of Violence, Government Effectiveness, Regulatory Quality, Rule of Law and Control of Corruption.

While market capitalization weights are the natural starting point for a global benchmark, as they represent the average portfolio held by investors, the purpose of these simulations is to understand potential improvements in diversification using alternative regional weighting schemes. The main alternative weighting schemes we simulated were weighting regions by GDP, risk weighting regions and equal weighting regions.

The reason for using total market capitalization weights in addition to free-float market cap benchmarks is that total market capitalization indexes represent the allocation of the average investor in the market. As we have seen in section one of this report, equity markets' total market capitalization is highly correlated to the free-float market capitalization. However, total market-cap weights attribute more benchmark weight to Emerging Markets, where average free-floats are lower. This may represent a more forward-looking view of investment opportunities in countries that have had strong economic growth: Economic growth often goes hand-in-hand with increasing market liberalization of ownership structures, which may herald increasing free-floats. At the same time, total market-cap weights underweight North America, the most liquid equity market, which currently accounts for almost 60% of global free-float market capitalization in equities and therefore may offer additional diversification benefits due to a more uniform regional allocation of assets.

Following our methodology for building global benchmarks (detailed later in section eight), we defined criteria that were used to evaluate benchmarks based on different regional weights: the representativeness and replicability of the benchmark, its risk and performance drivers, and potential improvements in diversification benefits compared to the standard benchmark. We looked at diversification from two perspectives: first, in the sense of reducing short-term market risks as measured by volatility, and second, in the sense of averaging out differences in the long-term growth trajectory of different regions, which is important for mitigating risks stemming from possible regional bubbles in equity prices.

Our comparison of these alternative approaches followed the afore-mentioned four main criteria: **representativeness and replicability** of the indexes for global equity markets, **performance, risk** and **diversification**.

We started with an assessment of **representativeness**: Taking a cautious approach of using existing regional benchmarks as a starting point (instead of building a benchmark methodology bottom up from the security level), we found that each regional weighting scheme resulted in a benchmark representing all GICS sectors and all four regions, where the strongest bias compared to the standard benchmark was found at a country level. Each of the three alternative approaches showed less concentration in regional allocation than MSCI ACWI (which is free-float adjusted

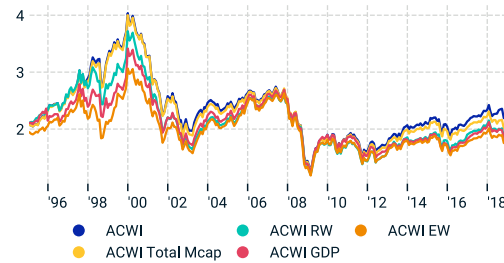
market-cap weighted). The key difference between free-float weights and alternative weighting schemes was in their regional allocation to North America versus Emerging Markets, whereas the weights for EMEA and Pacific were relatively similar. GDP- and risk-weighting regions underweighted North America less than equal weighting but offered more exposure to Emerging Markets than free-float weights.

We also observed that total market cap weighting and free-float weighting (to an even greater extent) led to better index **replicability** (higher liquidity and lower turnover).

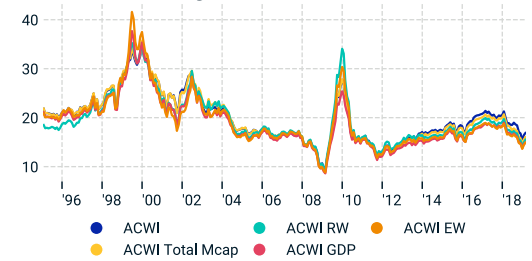
Our analysis of **performance** drivers showed that free-float market capitalization weights on average resulted in the highest average level of profitability and the highest average valuation levels, as shown in Exhibit 5, which compares free-float weighting (ACWI), total cap weighting (ACWI Total MCap), risk weighting (ACWI RW), GDP weighting (ACWI GDP) and equal weighting (ACWI EW).

Exhibit 5: Comparison of market fundamentals

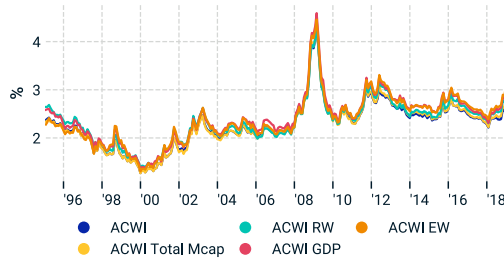
Price to Book Value



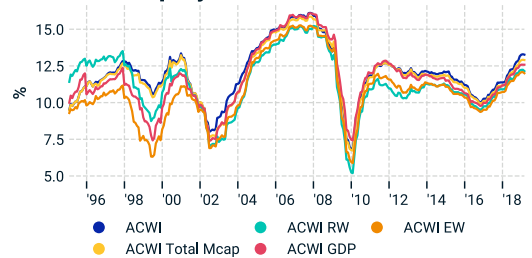
Price to Earnings



Dividend Yield



Return on Equity



Source: MSCI. Data from Dec. 30, 1994 to Feb. 28, 2019.

The free-float weighting approach had a high allocation toward profitable companies and therefore outperformed all other approaches during the second half of the study period, when valuation levels expanded. This was especially the case in North

America, which had the highest weight in the free-float market capitalization weighted simulation. However, we also saw the opposite effect during the first half of the study period, which started with the run-up to the dot-com equity bubble: Free-float market capitalization was more exposed to the bubble and ultimately all other approaches fared better when the bubble burst. In brief, we saw the highest level of cyclicity in valuation levels in free-float market capitalization weights.

Our analysis of the **risk profile** of alternative regional weighting schemes showed that alternative weighting schemes did not reduce financial risks as measured by volatility or Value-at-Risk compared to free-float weighting.

In addition, differences in **diversification** measures (diversification ratio, Gini coefficient) were quite small and showed only a fairly small improvement in diversification. This was because all approaches used the same set of securities and (as we saw in section two) stock diversification was the key contributor to global diversification ratios. While differences in diversifying short term market volatility were relatively small, we found more significant differences in terms of country concentration risks, with free-float market capitalization weights showing the highest level of country concentration. In particular, equal weighting and GDP weighting showed a significant reduction in country concentration.

In **section six** we look at different ways of creating alternative Emerging Market indexes to the existing MSCI Emerging Markets IMI, which is a free-float market cap index that targets 99% market coverage including large caps, mid caps and small caps.

We first look at regional differences in World Bank Governance scores and MSCI ESG Government Ratings.⁷ We observed that on both measures DM countries on average scored higher than EM countries and within DM markets European countries on average scored higher than countries in North America and Pacific. This illustrates that investors faced very different levels of country governance and ESG risks across different countries and regions, with Emerging Markets showing higher governance and ESG risks than DM.

Afterwards, we look at three approaches to create alternative benchmarks in EM: a reduction in the target market coverage, reducing the number of countries and capping the weight of large countries in EM. The purpose of these simulations is to assess the impact on index replicability and on country concentration risk.

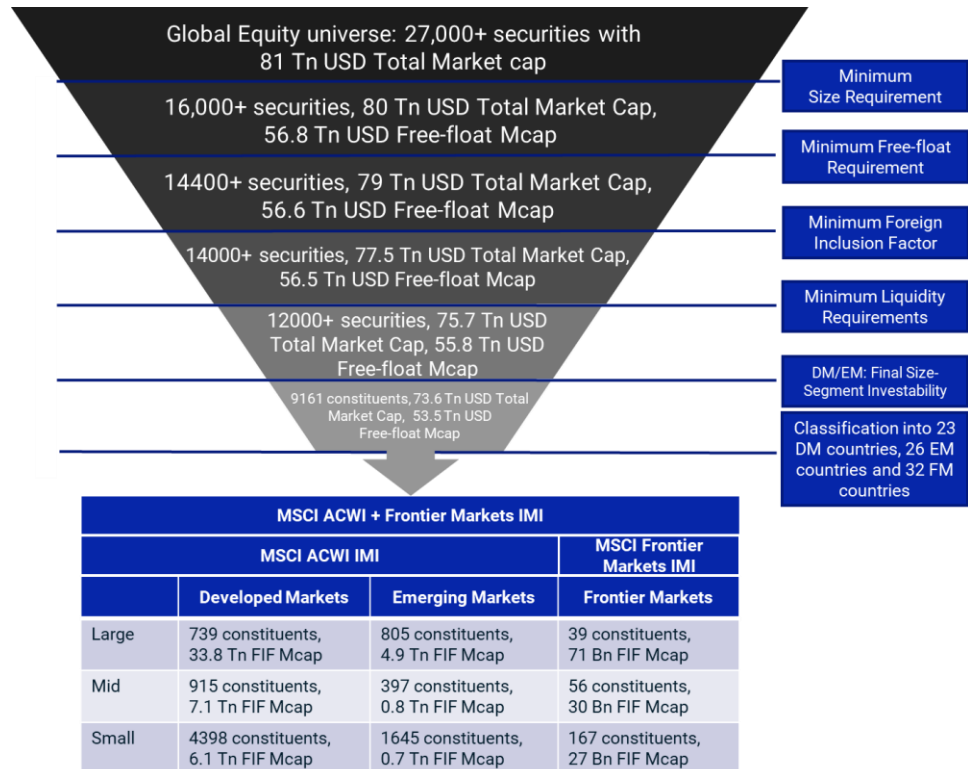
⁷ MSCI ESG Government Ratings assess the environmental, social and governance profile of sovereigns. It is not based on MSCI ESG Ratings for corporates.

The first two approaches – narrowing down the EM benchmark by excluding the smallest part of small caps or excluding countries with high levels of country risk (World Bank Governance score) led to lower performance, with the exclusion of countries showing relatively stronger negative performance effects. This means that during the study period investors were compensated for investing in smaller markets with lower levels of governance. The simulation of country caps in Emerging Markets to mitigate concentration risks showed a relatively small impact on risk and returns when applying a 20% or 30% cap. However, the application of a 10% cap showed a clear improvement in diversification and a reduction in financial risk. At the same time, we observed a clear increase in turnover, which was highest for the 10% cap.

The **seventh section** looks at additional sources of risk and return. To start with, we look at the size premium in global equity markets. We found a positive size premium during the study period from 1994 to end of February 2019. We also found the size premium to be slightly larger in an index targeting 99% of the global equity market compared to an index targeting only 90%. We also look at sector risks in global equity markets. We found that Technology and Financials have been very cyclical sectors and have shown more severe drawdowns in stressed markets than defensive sectors such as Consumer Staples.

The **eighth section** summarizes MSCI's Global Investable Market Index methodology, which is used for the construction and maintenance of the MSCI ACWI IMI series. The global listed equity universe consists of over 27,000 companies with over 81 trillion USD in market value as of February 2019, which MSCI uses as the basis for building benchmarks for Developed Markets, Emerging Markets and Frontier Markets by applying a set of transparent rules as summarized in Exhibit 6.

Exhibit 6: From the Global Equity Universe to the MSCI Global Investable Market Indexes



Source: MSCI. As of 17 April 2019 (the price cutoff date of the semi-annual index review as defined in the MSCI Global Investable Market Indexes Methodology).

From a conceptual point of view, MSCI’s benchmarks are built to ensure they are representative of the underlying equity markets, are replicable, and that their methodology framework is efficient. A key element of the methodology framework is market classification, which uses economic development, size and liquidity, and market accessibility criteria to classify markets as Developed, Emerging or Frontier. Changes to market classifications or other material elements of the benchmark methodology involve broad market consultation before they are decided and implemented. For instance, MSCI conducted four rounds of market consultation before deciding on a partial inclusion of China A shares into the MSCI ACWI IMI benchmark. All MSCI’s benchmarks are subject to a strict internal governance framework that is controlled by internal committees and includes a “Chinese Wall” for all MSCI employees who have access to potentially price-sensitive information.

Introduction

For the past several decades, global equity markets have provided return enhancement and risk diversification opportunities for long term institutional investors. Global equity markets have evolved gradually through this time. Initially, international investments focused on Developed Markets. Over the last 30 years, Emerging Markets have however provided additional opportunities for global equity investors.

While the expansion of global equity markets has created numerous new investment opportunities, it has also created new risks and has made risk management a more demanding task for global asset owners. Global markets have become increasingly interconnected due to the rising share of trade in relation to global output and due to more cross-regional investment and lending, as witnessed by the decline in asset owners' home bias. This makes the identification of risks more complex, because even companies that have all their production within Developed Markets may have a significant economic exposure to Emerging Markets from their trading or investments.

Consequently, an understanding of the development of cross-regional market correlations has become increasingly important during the past decade for diversifying risks in a global asset portfolio. This task has been made even more challenging by increasing concentration risks: In recent years, equity market growth has been uneven and has led to a concentration of U.S. equities in Developed Markets and of China equities in Emerging Markets. Even within markets, we have seen an increasing concentration of risk exposures: For instance, in 2018 several U.S. technology companies surpassed a market valuation of 1 trillion USD, higher than the GDP of the Netherlands and more than twice that of Norway. At the same time, average correlations between these technology stocks have increased noticeably. In other words, the corporate risks of these companies to investors have reached an almost macro-economic level.

The purpose of this research report is to address these challenges by assessing the long-term risk and return drivers in global equity markets, and their regional differences. In addition, we tested different ways to benchmark global equity markets by using and simulating various regional weighting schemes and comparing them to GPF's current benchmark. A key focus of this comparison was understanding how to diversify financial risks effectively across global regions. Consequently, this report seeks to derive key insights when defining GPF's regional asset allocation and constructing a corresponding global equity benchmark. In addition, the report

assesses the role of Emerging Markets in growing the global opportunity set and how this may affect a global benchmark going forward.

The structure of this report is as follows: The first section provides an update on the globalization of economic activity and trade and the growth of the global equity opportunity set.

The second section provides an overview of correlation structures in global equity markets to identify natural regional building blocks for asset allocation and assesses potential diversification benefits in global markets.

Section three provides an analysis of the fundamental risk and return drivers for equity markets at a regional level as well as an analysis of country equity risk premia.

Section four looks at historical and fundamental performance stress tests for regional equity markets.

Section five analyzes different regional weighting schemes applied to a global benchmark and explores whether performance characteristics and regional diversification can be improved by using different weighting schemes.

Section six assesses different ways of creating benchmarks for Emerging Markets. Section seven looks at additional drivers of risk and return, such as the size premium in global equity markets and the importance of sector risks in global equity markets.

Finally, the eighth section summarizes MSCI's methodology and governance framework for the calculation and maintenance of global benchmarks, including a description of MSCI's country classification framework and MSCI's market consultation policy.

Definitions used in this report

In this report, we use standard MSCI indexes to define the global equity opportunity set as well as the universe of countries and companies that we look at in our analysis of economic trends. While section eight provides a detailed description of MSCI's methodologies for market classification and index construction, it is important to understand the following definitions that are used throughout all sections of this report:

- MSCI classifies countries as **Developed**, **Emerging** and **Frontier** markets, based on criteria for countries' economic development, the size of the capital market, and the liquidity and accessibility of the local stock market.
- The **total market capitalization** of a stock is its price times the number of outstanding shares.

- The **free-float adjusted market capitalization** of a stock is the part of total market capitalization that excludes closely held shares. It is calculated by multiplying the total market capitalization of a stock by the foreign inclusion factor (which measures the proportion of shares available to foreign investors).
- **MSCI ACWI IMI** is a free-float adjusted market capitalization weighted index that targets 99% market coverage of Developed and Emerging Markets and includes large caps, mid caps and small caps. It is broken down into Developed Markets (**MSCI World IMI**) and Emerging Markets (**MSCI Emerging Markets IMI**). MSCI World IMI can be broken down into three regions: **MSCI North America IMI**, **MSCI EMEA IMI** (Europe and Middle East) and **MSCI Pacific IMI**. All these regional indexes are free-float adjusted.
- **MSCI ACWI** is a free-float adjusted market capitalization weighted index that targets 85% market coverage of Developed and Emerging Markets and includes large caps and mid caps (no small caps). It is broken down into Developed Markets (**MSCI World**) and Emerging Markets (**MSCI Emerging Markets**). MSCI World can be broken down into **MSCI North America**, **MSCI EMEA** and **MSCI Pacific**. All these regional indexes are free-float adjusted.
- In this report we use MSCI World IMI and MSCI World as a representation of Developed Markets' equity opportunity set and MSCI Emerging Markets IMI and MSCI Emerging Markets as a representation of Emerging Markets' equity opportunity set. We frequently abbreviate Developed Markets to **DM** and Emerging Markets to **EM**. For instance, **MSCI EM** is an abbreviation for MSCI Emerging Markets.
- **Annualized Traded Value Ratio** (ATVR) is used in this report to assess the liquidity of securities in benchmarks. ATVR corresponds to the annualized traded value of a security relative to its free-float adjusted market capitalization.

All index returns are calculated in USD unless explicitly stated otherwise.

1. Global economic and financial integration

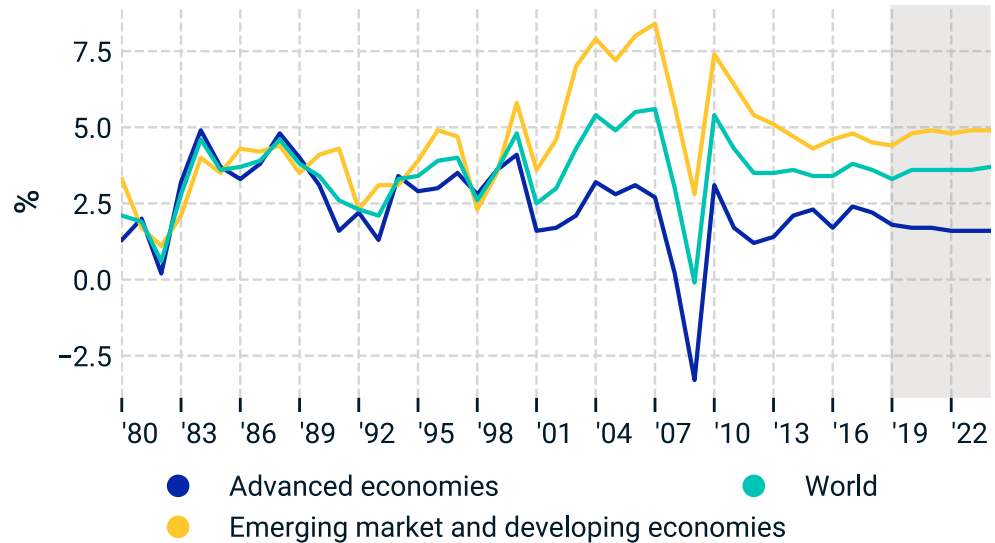
In the first section of this report we will look at global economic trends in developed and emerging markets in terms of output growth and growth in corporate sales. We also look at how these economic growth trends have affected the global equity opportunity set and how far global institutional investors have shifted their investment strategies toward a global asset allocation model.

Macro-economic trends

Since MSCI's report "Global Equity Allocation – Analysis of Issues Related to Geographic Allocation of Equities" prepared for the Norwegian Ministry of Finance in March 2012, the global economic recovery from the financial crisis continued. GDP growth rates stabilized in both advanced and emerging economies⁸ (Exhibit 7) and are forecast to remain stable at around 2% annually for advanced economies and between 4 and 5% for emerging and developing economies over the next five years. In a historical context, this means that the growth gap between emerging and advanced economies, which peaked in 2009 at 6.1%, practically halved over the past decade and is expected to remain around 3% during the coming five years. This growth advantage for emerging economies contrasts with the 1980s and 1990s, when advanced and emerging economies grew at about the same pace.

⁸ IMF's classification of countries comprises advanced, emerging and developing economies and is not exactly congruent to MSCI's classification of countries into Developed, Emerging and Frontier Markets.

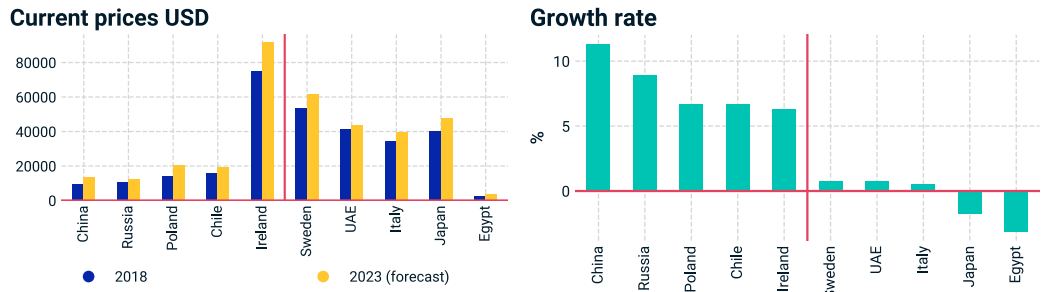
Exhibit 7: GDP growth in % per year



Source: IMF. Historical data from 1980 to 2018. Forecasts from 2019 to 2024.

From a global investor’s perspective, it is also important to understand the degree of dispersion in economic growth in each region: A high degree of dispersion in growth rates may make a region more susceptible to shocks and economic downturns compared to regions with relatively uniform growth rates. Therefore, Exhibit 8 shows the economic development of the countries with the highest and lowest growth rates over the 30-year period ending 2018 in Developed and Emerging Markets. On average, economic growth rates were much higher for Emerging Markets than Developed Markets. However, Emerging Markets also showed higher levels of dispersion in growth rates, with China leading the table of high growth rate countries and Egypt placed last. Among Developed Markets, we find Japan and European countries at the bottom of the league table. In brief, GDP growth in Emerging Markets increasingly hinges on the growth trajectory of China, its regional heavyweight, and a similar conclusion can be drawn for Emerging Markets’ equity markets.

Exhibit 8: GDP per capita



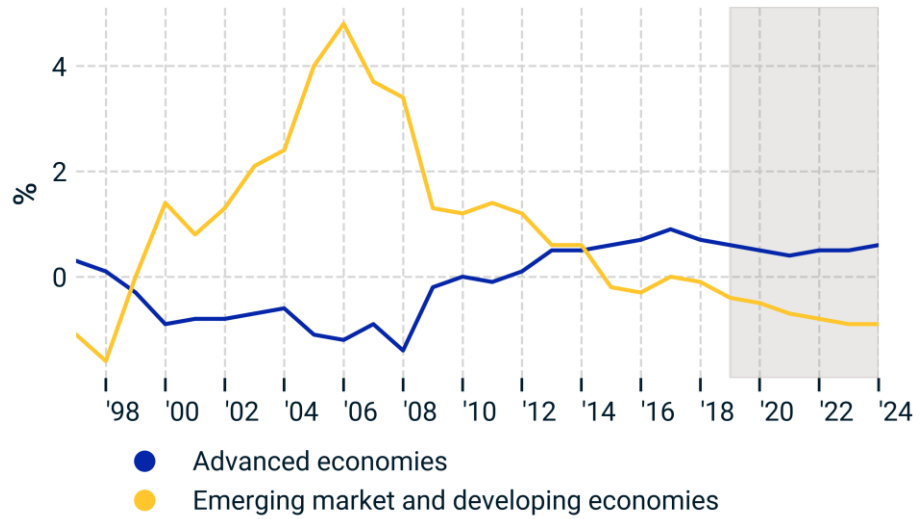
Source: Left: IMF - GDP per capita, current prices USD. Right: GDP growth rate calculated using data as of 1988 and 2018.

The global recovery from the financial crisis meant that global current account imbalances shrank significantly during the past decade (Exhibit 9). This is important as current account imbalances historically had a destabilizing effect on the global economy, making capital markets more susceptible to external economic shocks, especially for countries that had accumulated external debt in foreign currency and were therefore vulnerable to shocks to the value of their currency and withdrawals of foreign capital. For instance, the Asian crisis of 1997 was triggered by a collapse of the Thai baht and a rapid withdrawal of foreign capital.

Global current account imbalances shrank for two reasons. First, in Emerging Market economies domestic demand grew faster than demand from trading partners. Second, capital borrowing by Developed Markets and the consequent accumulation of foreign reserves by Emerging Markets decreased due to economic belt tightening in Developed Markets in the aftermath of the financial crisis. The development of China as the largest emerging economy illustrates these two effects:⁹ China’s domestic demand grew by 9.2% annually between 2008 and 2017, while global demand for Chinese exports grew by just 2.9% annually in the same period. In parallel, the growth rate of Chinese FX reserves, which had peaked at above 400 bn USD annually around 2008-2009, fell steadily and is forecast to be close to zero in the coming five years.

⁹ Source: Oxford Economics, CEIC Data. <https://www.brinknews.com/asia/implications-of-chinas-shrinking-current-account-surplus/>

Exhibit 9: Current account balance in % of GDP¹⁰

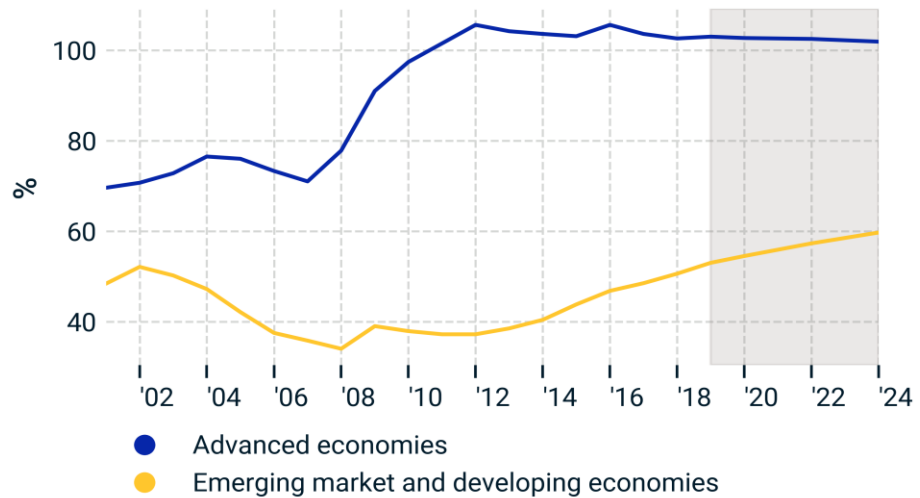


Source: IMF. Historical data from 1997 to 2018. Forecasts from 2019 to 2024.

This development is also reflected in debt to GDP ratios (Exhibit 10): The indebtedness of developed economies had increased rapidly during the financial crisis due to the costly bail-out of the banking sector in the U.S. and Europe. However, after 2012 debt ratios started to decrease in Developed Markets due to fiscal austerity measures. By contrast, in 2012 debt ratios started to increase in emerging economies due to more expansionary fiscal policies, although they still remain well below debt levels seen in developed countries.

¹⁰ IMF's classification of countries comprises advanced, emerging and developing economies and is not exactly congruent to MSCI's classification of countries into Developed, Emerging and Frontier Markets.

Exhibit 10: Debt to GDP in %

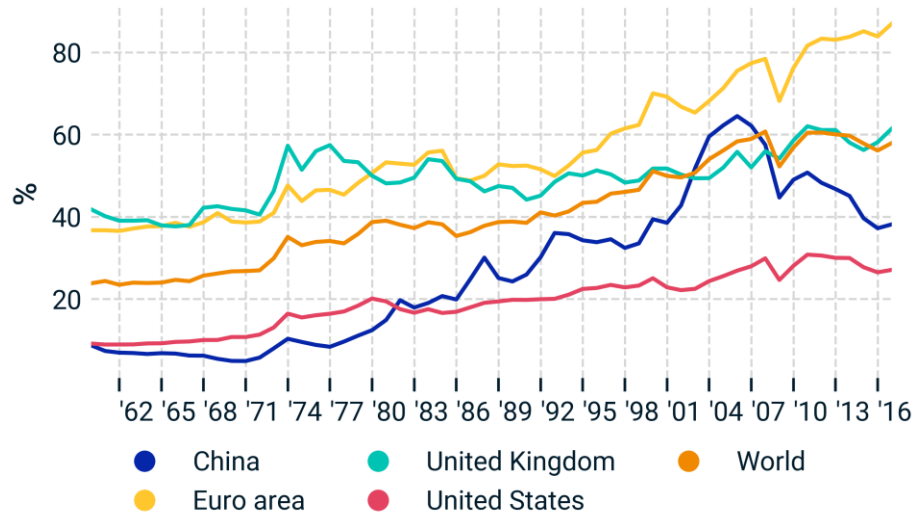


Source: IMF. Historical data from 2001 to 2018. Forecasts from 2019 to 2024.

The difference in borrowing behavior between developed and emerging economies is even clearer from their respective contributions to the global debt to GDP ratio: Mbaye et al. (2018) have observed that Emerging Markets’ share of global debt increased in the past decade, while Developed Markets’ share fell. Consequently, investors need to stay alert to risks related to sovereign debt in Emerging Markets.

Another macro-economic risk over recent years has been increasing protectionism, as seen in the form of the trade war between the U.S. and China, and as a possible outcome of the U.K.’s decision to leave the European Union (“Brexit”). The exposure of economies to the risk of protectionism can be proxied by their global trade to GDP ratios, shown in Exhibit 11. Overall, the world’s trade to GDP ratio rose from about 40% in 1980 to almost 60% in 2016, reflecting the increasing trend toward globalization, although there were strong regional differences: The U.S. ratio remained below 30% due to the strong economic focus on domestic demand. China’s ratio peaked just before the financial crisis at above 60% but has now fallen below 40% due to the growth in domestic demand. China has become less vulnerable to the risk from trade wars compared to 10 years ago. However, the eurozone and U.K. ratios are significantly higher (close to 60% for the U.K. and above 80% for the eurozone), highlighting Europe’s risk exposure to trade wars and the potential effects of Brexit.

Exhibit 11: Global trade to GDP



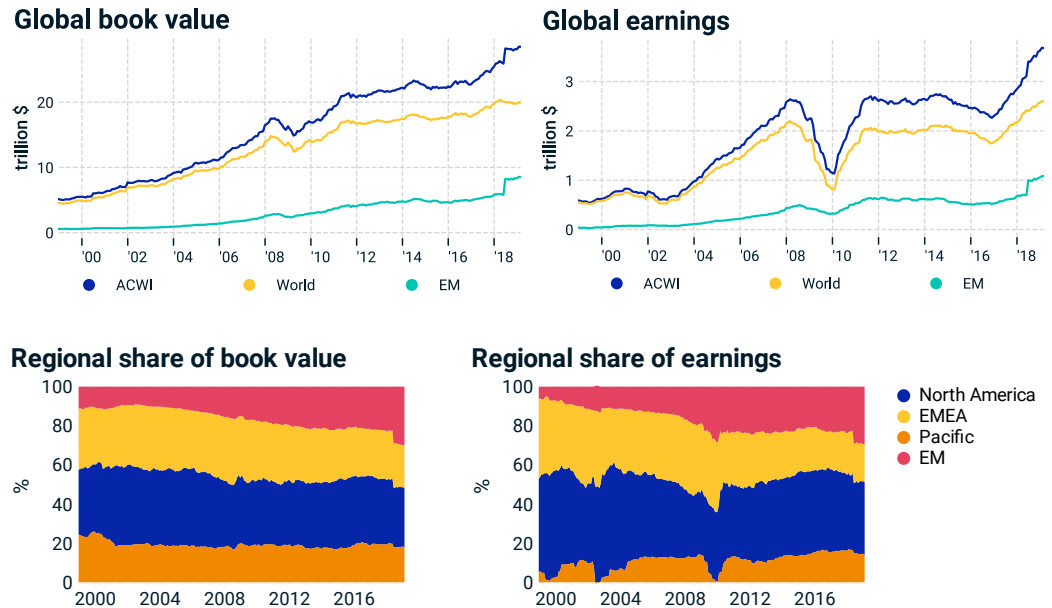
Source: World Bank. Historical data from 1960 to 2017.

Internationalization of the corporate sector

Next, we look at how the globalization of economic activity has affected the global corporate sector. To start with, Exhibit 12 shows the evolution of global corporate earnings and corporate book value over time.¹¹ Overall, earnings and book values have followed the business cycle with a clear drop in both measures during the financial crisis. We also observe that Emerging Markets’ share of global book value grew significantly during the study period. In addition, we observe strong growth in earnings during the past five years in both Developed Markets and Emerging Markets.

¹¹ The analysis of corporate sales, corporate earnings and corporate book values in Exhibit 12, Exhibit 13 and Exhibit 14 is based on corporates’ total market capitalization, i.e., they are not adjusted for free-float.

Exhibit 12: Global development of corporate book values and corporate earnings¹²



Source: MSCI. Data from Dec. 31, 1998 to Feb. 28, 2019.

As of February 2019, North America accounted for about 31% of global corporate book value, about 38% of corporate earnings and about 58% of global free-float market capitalization (Exhibit 13). The relatively higher share of free-float market capitalization is due to higher levels of equity valuation in North America, as we will discuss in section three below.

Exhibit 13: Regional breakdown of fundamentals

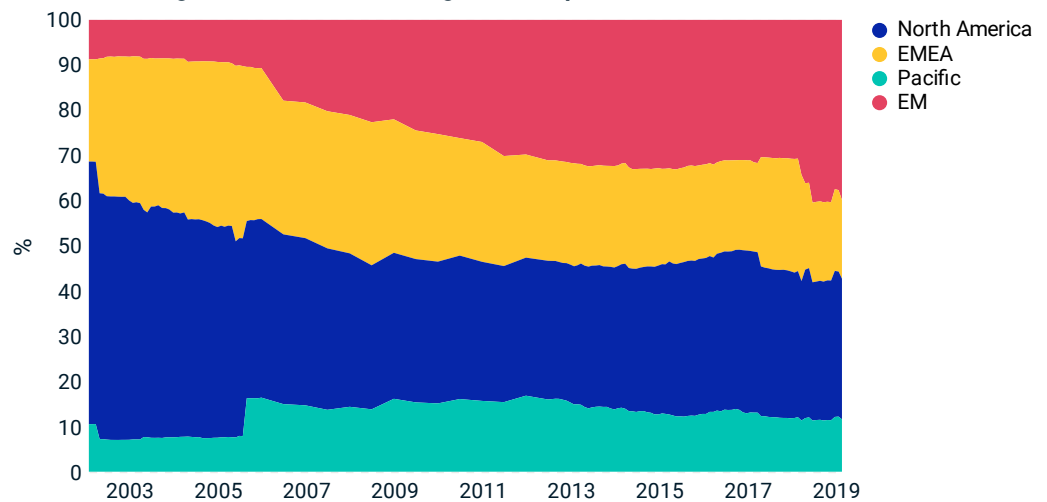
Region	North America	EMEA	Pacific	EM
Free float weight	57.95	19.25	11.14	11.66
Total mcap weight	46.57	18.41	11.6	23.41
Book Value	30.69	21.69	17.7	29.91
Earnings	37.63	19.24	13.7	29.43

Source: MSCI. Data as of Feb. 28, 2019.

¹² As described in the introduction, we use MSCI World to represent Developed Markets and MSCI Emerging Markets to represent Emerging Market countries.

The increasing level of global economic integration has also been reflected in the globalization of companies’ sales revenues, which we refer to as economic exposure (Gupta and Subramanian, 2014). While the earlier analysis of global GDP focused on the supply side of the economy, economic exposure reflects the demand side by analyzing where corporates’ sales revenues are generated. To be precise, we calculate each region’s share of global sales in USD (without any adjustment for corporate free-float). In recent years we saw a steady increase in Emerging Markets’ share of global sales revenues (Exhibit 14).

Exhibit 14: Regional distribution of global corporate sales revenues



Source MSCI. Data from Dec. 31, 2002 to Feb. 28, 2019

This illustrates that Emerging Markets have not only grown in terms of economic supply, but also in terms of consumption. It also reflects the afore-mentioned trend of China moving from an export led growth model to more consumption-based growth.

To analyze deeper, the rows in Exhibit 15 show the distribution of sales revenues within various regional and global MSCI benchmarks and the respective free-float weight. Different regions show very different levels of diversification of sales revenues: The least diversified sales revenues were found in Emerging Markets, where over 85% of sales were within the same region, followed by North America, where over 70% of sales were generated in the region. The most diversified sales profile was found in EMEA, where only about 48% of sales were generated internally. Further, we note that Developed Markets regions had very different levels of sales exposure to Emerging Markets: Over 27% of EMEA sales were generated in Emerging

Markets, compared to 20% in Pacific and 15% in North America. This shows that the North American corporate sector has been much more focused on servicing domestic demand than the corporate sector in EMEA, which generated over half of its sales revenues outside the region.

Exhibit 15: Geographical distribution of revenues of various MSCI benchmarks

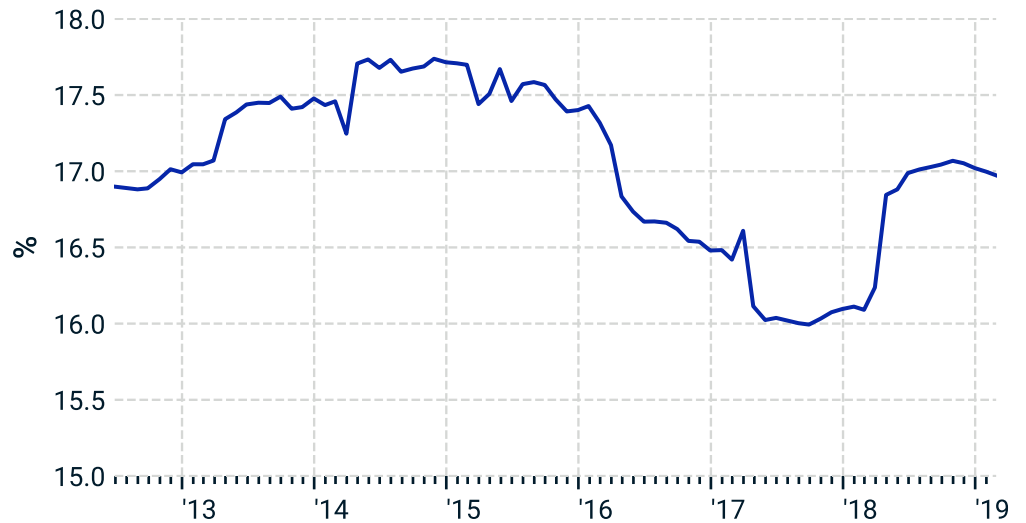
	North America		EMEA		Pacific		EM	
	Mcap weight	Revenue	Mcap weight	Revenue	Mcap weight	Revenue	Mcap weight	Revenue
North America	100%	70.99%	0%	10.47%	0%	3.34%	0%	15.2%
EMEA	0%	19.95%	100%	47.97%	0%	4.7%	0%	27.37%
Pacific	0%	13.47%	0%	6.16%	100%	60.28%	0%	20.08%
EAFE	0%	17.54%	63%	32.42%	37%	25.38%	0%	24.66%
World	66%	41.92%	22%	22.41%	13%	15.33%	0%	20.34%
EM	0%	6.01%	0%	5.44%	0%	2.8%	100%	85.76%
ACWI	58%	30.01%	19%	16.78%	11%	11.17%	12%	42.03%

Source: MSCI. Data as of Feb. 28, 2019.

The revenue exposure of Emerging Markets also includes the frontier markets and other countries. The revenue exposures reported are the revenue weights of the benchmarks, independent of benchmark weights.

To probe deeper into how Developed Markets corporates have diversified their sales revenues into Emerging Markets, Exhibit 16 shows the percentage of Developed Markets corporate sales in Emerging Markets, which has been about 17% in recent years.

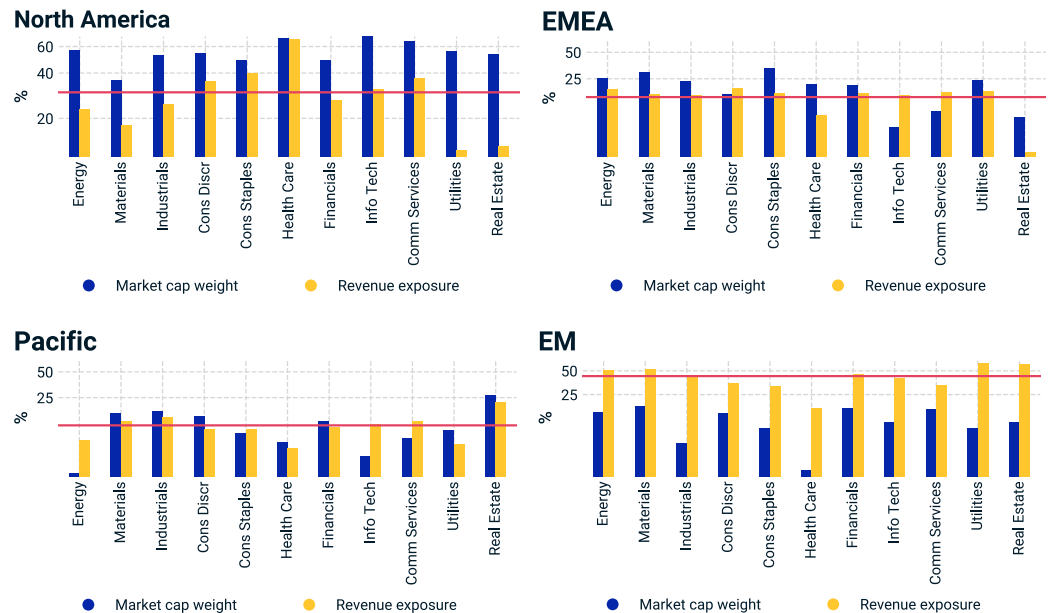
Exhibit 16: Share of DM sales going into EM



Source: MSCI. Data from Jun. 29, 2012 to Feb. 28, 2019.

In addition, Exhibit 17 compares the sales revenue exposure of each sector and region to the respective benchmark weight (in MSCI ACWI) and sales averages across all sectors (red lines). Overall, Emerging Markets accounted for about 40% of global sales revenues, which was clearly above their global benchmark weight as well as their share of global GDP. On the other hand, while North America only accounted for about 30% of global sales, it had a weight of about 60% in the global benchmark. For EMEA and the Pacific region, economic exposures were closer to their benchmark weights. However, there were clear sectoral differences in all regions: for instance, in North America the economic exposure of the Real Estate sector was only a fraction of its benchmark weight, whereas the economic exposure of the Health Care sector in Emerging Markets was a multiple of its benchmark weight.

Exhibit 17: Economic exposure of MSCI ACWI sectors to regional markets¹³



Source: MSCI. Data as of Feb. 28, 2019. Horizontal line defines the mean revenue exposure.

In section three of this report, we continue our analysis of economic exposure to assess how far Emerging Markets’ growth in demand may be a driver for stock performance.

Globalization of financial markets

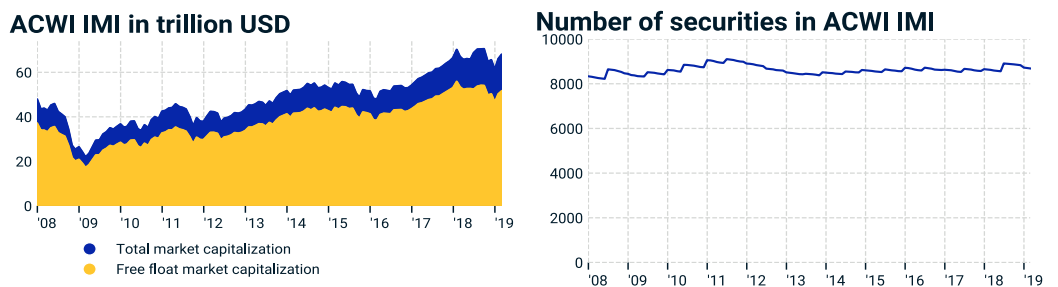
From an institutional investor’s perspective, the key question is how far the globalization of economic activity affects financial corporate performance and the global equity opportunity set. For the analysis presented in this report, we use the MSCI ACWI IMI to define the global opportunity set. The index covers approximately 99% of the market capitalization of all listed large-cap, mid-cap and small-cap securities in Developed and Emerging Markets.

The number of securities in ACWI IMI has been relatively stable over the past decade, with only a slight decrease in listed companies in the immediate aftermath of the

¹³ The chart shows the distribution of free-float adjusted market capitalization and economic exposure for each GICS sector across the four regions. Consequently, for each GICS sector the economic exposure and free-float weights add up to 100% respectively.

financial crisis (Exhibit 18). This historical view of listed securities also illustrates the bi-annual review frequency, with newly listed companies entering the universe at review dates. By contrast, total-market capitalization and free-float adjusted market capitalization followed equity market movements, with the trough coinciding with the financial crisis and a decade-long recovery thereafter. We also observed a slight increase in the gap between total market capitalization and free-float adjusted market capitalization, due to the growth of Emerging Markets.

Exhibit 18: ACWI IMI market capitalization and number of securities



Source: MSCI. Data from Dec. 31, 2007 to Feb. 28, 2019.

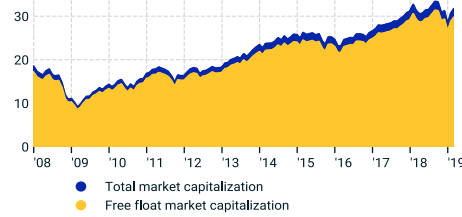
We continue our assessment of global equity markets by looking at the development of the regional opportunity set in Developed North America, Developed EMEA, Developed Asia Pacific and Emerging Markets. We use the MSCI ACWI North America IMI, MSCI ACWI EMEA IMI, MSCI ACWI Pacific IMI and MSCI ACWI Emerging Markets IMI benchmarks to represent these regions in our analysis.

As a first step, Exhibit 19 looks at how the regional opportunity sets have evolved over the past decade within MSCI ACWI IMI. We see that in the aftermath of the financial crisis from 2011 to 2013, the number of listed securities fell slightly in all regional markets, with EMEA showing the largest and most persistent decline. In contrast, the number of listed securities in Emerging Markets increased slightly after 2013 and ticked up in 2018 with the inclusion of China A shares. Overall, the total market capitalization and free-float market capitalization of the regions followed the price movement in their equity markets.

However, we observe that for Emerging Markets, the average free-float capitalization is the lowest as a percentage of total market capitalization among all regions, and has been falling, especially with the inclusion of China A shares in 2018. As of end-2018, less than half of Emerging Markets' total capitalization was free-float. This reflects that emerging equity markets such as China A shares are not as accessible and liquid as developed equity markets, especially in comparison with North American markets, where average free-float ratios are close to 100%.

Exhibit 19: Growth of four regional opportunity sets within MSCI ACWI IMI

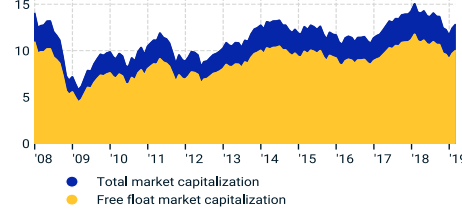
North America IMI in trillion USD



Number of securities in North America IMI



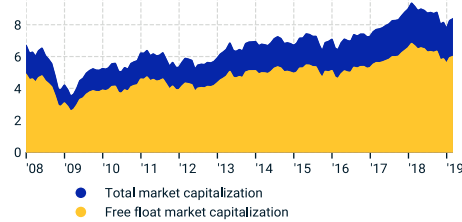
EMEA IMI in trillion USD



Number of securities in EMEA IMI



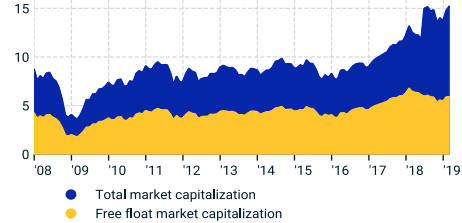
Pacific IMI in trillion USD



Number of securities in Pacific IMI



EM IMI in trillion USD



Number of securities in EM IMI



Source: MSCI. Data from Dec. 31, 2007 to Feb. 28, 2019.

Sector opportunity set

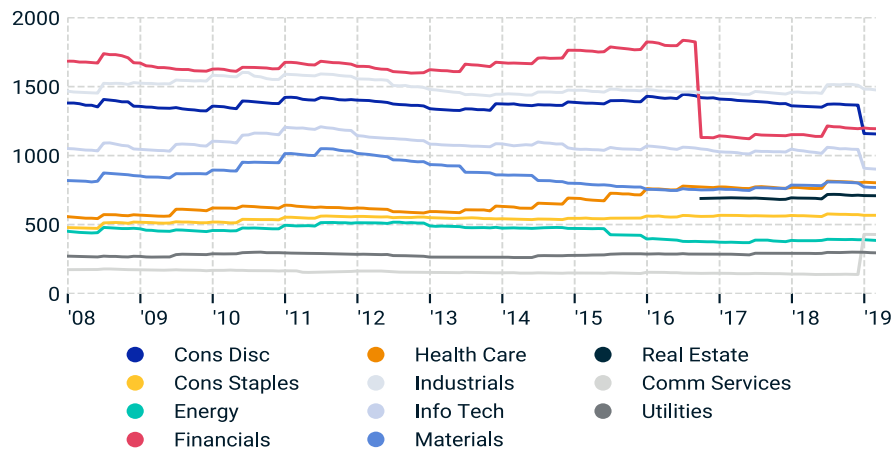
Next, we investigate the growth of the opportunity set for GICS® sectors¹⁴ of MSCI ACWI IMI during the past decade in terms of number of securities (Exhibit 20) and relative market size (Exhibit 21). During the past decade there was a continuous

¹⁴ GICS, the global industry classification standard jointly developed by MSCI Inc. and S&P Global.

decline in the number of listed securities in the Materials and Energy sectors, while Health Care and Consumer Staples saw a continuous increase. Changes to the GICS classification in September 2016 led to the Real Estate sector being split from Financials, while the reclassification of Communication Services resulted in companies switching from the Information Technology and Consumer Discretionary sectors in September 2018.

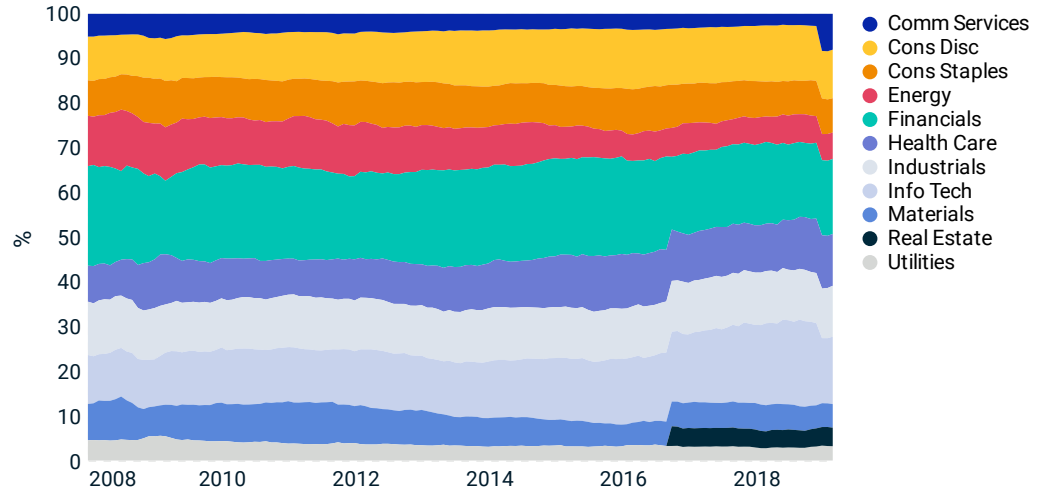
In terms of market size (Exhibit 21), the Financials sector staged a rebound after the financial crisis to be the largest sector until 2018, when it was briefly surpassed by the Information Technology sector (before the GICS reclassification saw part of the Information Technology sector migrate to Communication Services). The relative decline of the Energy sector was also reflected in its declining market size.

Exhibit 20: Number of securities in MSCI ACWI IMI sector indexes



Source: MSCI. Data from Dec. 31, 2007 to Feb. 28, 2019.

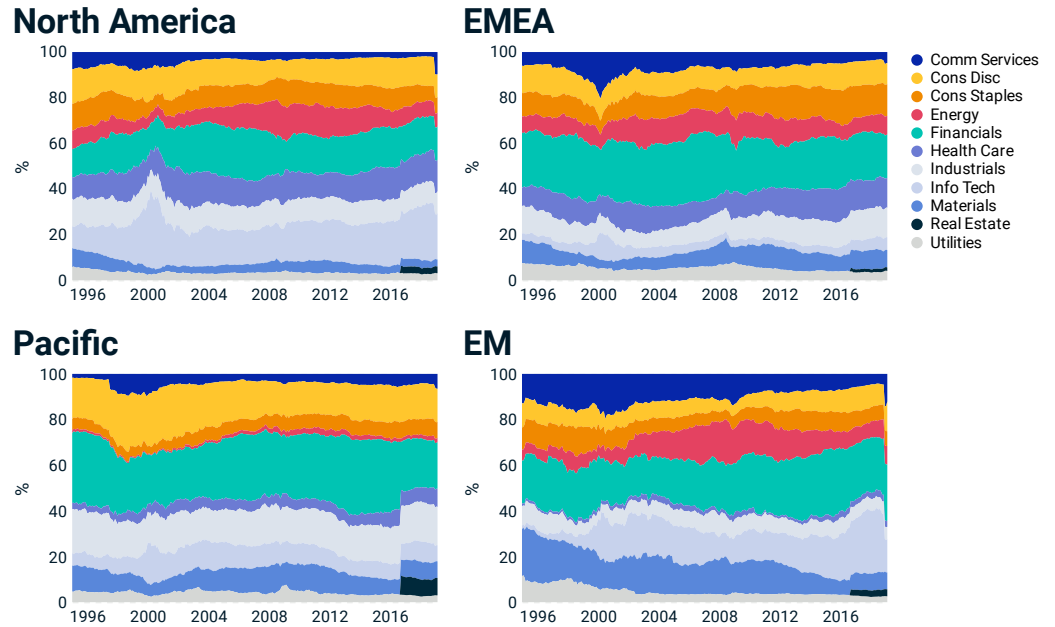
Exhibit 21: Free-float weights of MSCI ACWI IMI sector indexes



Source: MSCI. Data from Dec. 31, 2007 to Feb. 28, 2019.

In addition, Exhibit 22 shows the resulting sector composition of each region. We observe that the decline of the Energy sector mentioned above at a global level was mirrored in all four regions. By contrast, the global growth of Information Technology was only visible in North America and Emerging Markets. This suggests that the Pacific region and EMEA in particular have missed out on the opportunities for Information Technology to drive stock market growth. Some other regional differences stand out: While the Health Care sector was important in North America and EMEA, it was small in Pacific and Emerging Markets. The Materials sector has been very small in North America compared with the other three regions.

Exhibit 22: Sector composition of four regional equity markets



Source: MSCI. Data from Dec. 30, 1994 to Feb. 28, 2019.

The role of Emerging Markets

From a global asset allocation perspective, it is important to understand the growing role Emerging Markets play in the global economy and the extent to which this is reflected in the equity markets opportunity set. Exhibit 23 chronicles the introduction of new equity markets into the MSCI Emerging Markets Index and the MSCI Frontier Markets Index. Currently, the MSCI Emerging Markets Index comprises 24 markets, representing 12% of the MSCI ACWI Index.

Exhibit 23: Additions to MSCI Emerging Markets and MSCI Frontier Markets indexes

1988	1989	1992	1993	1995	1996	1997	2001
Argentina	Indonesia	South Korea	Colombia	Israel	China	Russia	Egypt
Brazil	Turkey		India	Poland	Czech Rep.	Portugal	Morocco
Chile			Pakistan	South Africa	Hungary		
Greece			Peru		Taiwan		
Jordan			Sri Lanka				
Malaysia			Venezuela ²				
Mexico							
Philippines							
Portugal							
Thailand							
2006	2007	2008	2009	2012	2016	2018	2019
Bahrain	Bulgaria ¹	Lithuania	Bangladesh	Saudi Arabia ³	WAEMU	China A ⁴	China A ⁴
Kuwait	Croatia	Serbia	Trin. & Tob. ¹				Argentina
Oman	Estonia						Saudi Arabia
Qatar	Kazakhstan						
UAE	Kenya						
	Lebanon						
	Mauritius						
	Nigeria						
	Romania						
	Slovenia						
	Tunisia						
	Ukraine ¹						
	Vietnam						

Country Introduced as **Emerging Market**/Frontier Market

¹ Trinidad and Tobago, Ukraine and Bulgaria were removed from the MSCI Frontier Markets Index in 2001, 2015 and 2016, respectively.

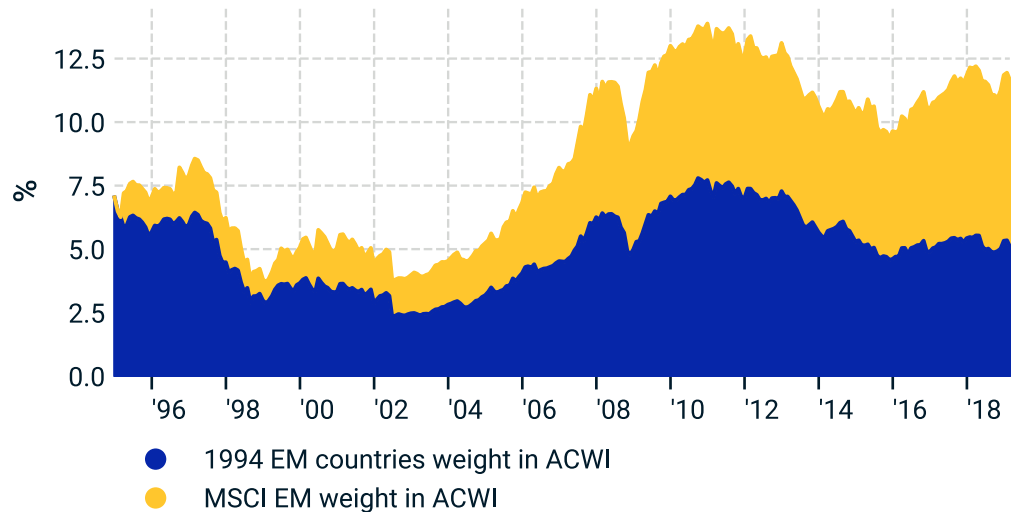
² Venezuela was removed from the MSCI Emerging Markets Index in 2006.

³ Saudi Arabia was re-introduced into the MSCI Domestic Indices as standalone index in 2012 and into the MSCI International indexes as standalone in 2015.

⁴ In March 2018 the MSCI China A index was launched, offered in CNH and CNY versions. In May 2018 Large Cap China A shares were added to the MSCI China index, the MSCI Emerging Markets index and MSCI ACWI index at 5% of their FIF-adjusted market cap. The inclusion factor of China A will be raised to 20% in three steps in 2019.

It is interesting to note that over the past 25 years, the key driver for the increasing weight of Emerging Markets within the global benchmark was the inclusion of additional countries into Emerging Markets, as illustrated in Exhibit 24, which compares the global benchmark weight of countries classified as Emerging Markets at the beginning of the study period to the actual EM benchmark weight over time.

Exhibit 24: Weight of EM countries (1994 sample) vs actual weight of EM in MSCI ACWI

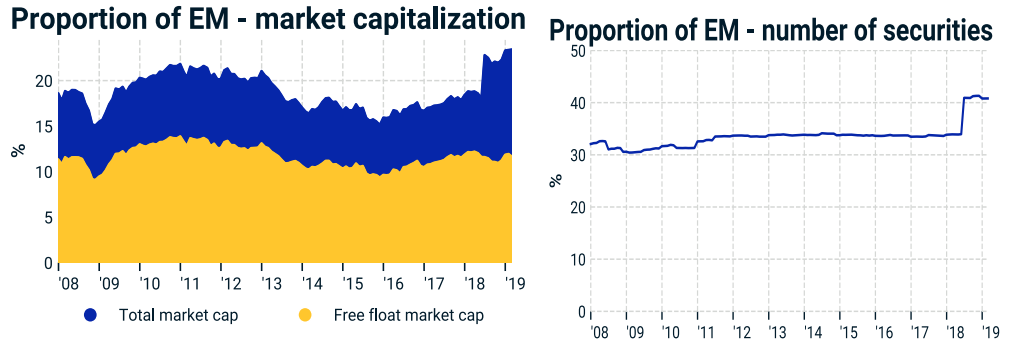


Source: MSCI. Data from Dec. 30, 1994 to Feb. 28, 2019.

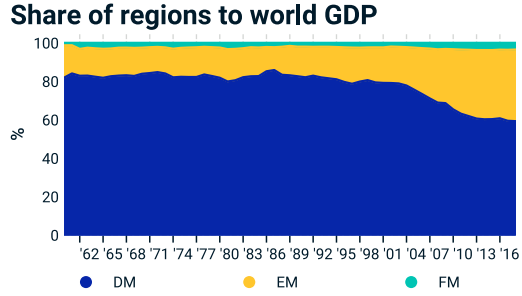
Exhibit 25 explores Emerging Markets’ share of global GDP (not adjusted for purchasing power) and of equity market capitalization: Their share of global GDP has grown to over a third, due to higher GDP growth rates as shown in section one. However, their role in global equity markets has not fully reflected this macro-economic growth. Emerging Markets’ share of global free-float adjusted market capitalization remained between 10% and 15% during the past decade. In addition, even after the partial inclusion of China A shares in 2018, Emerging Markets’ share of global total market capitalization was still below 25%.

Emerging Markets’ equity market capitalization lags their share of GDP for two reasons. First, market accessibility and market openness is still weaker for Emerging Markets than for Developed Markets, and consequently their benchmark weight is lower than their economic weight. For instance, as of the end of 2018, China A shares were only partially included in the benchmark. Secondly, Emerging Market equities underperformed Developed Market equities during the past decade, due to the slower expansion of equity valuations in Emerging Markets (see details below in section three).

Exhibit 25: EM relative to MSCI ACWI IMI: market capitalization (left), number of constituents (right) and GDP (below)



Source: MSCI. Data from Dec. 31, 2007 to Feb. 28, 2019.



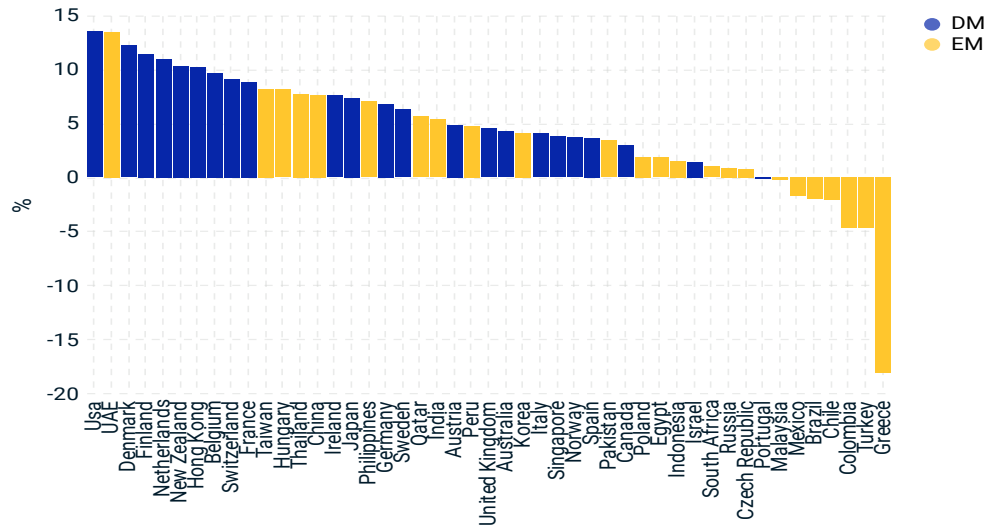
Source: MSCI. Data from Jan. 01, 1960 to Jan. 01, 2017

We also observe that the difference between total market capitalization and free-float market capitalization is higher in Emerging Markets (Exhibit 19 and Exhibit 25) than in Developed Markets.

Globalization of investors

It is important to mention that the economic recovery seen since MSCI’s previous report for the Norwegian Ministry of Finance in March 2012 was also widely reflected in the performance of equity markets – albeit with clear differences across countries, as shown in Exhibit 26: The U.S. equity market led the performance table, while the economic problems in Greece made it the worst performing equity market in recent years.

Exhibit 26: Annualized performance of country indexes since 2012



Source: MSCI. Data from Jan. 31, 2012 to Feb. 28, 2019. Performance is annualized.

The afore-mentioned long-term trend toward the globalization of economic activity has gone hand-in-hand with an increasing integration of capital markets and has been mirrored by institutional investors’ capital allocations, which were traditionally focused on the domestic market: Historically, most institutional investors separated equity policy portfolios into domestic and international equities at a strategic level, with a significant “home bias” that over-weighted domestic equities.¹⁵

Exhibit 27 shows current levels of home bias in selected European equity markets, as well as the U.S. and Japan, using data from the Coordinated Portfolio Investment Survey (CPIS) conducted by the IMF. The data shows significant home bias in these markets, with Japan being the most home-biased, and the U.S. level still exceeding 40% in 2018. However, we also observe a sharp decline in home bias over the past decade, especially for Norway, and to an even greater extent for the Netherlands, where home bias disappeared entirely in 2018. In addition, several large global pension funds recently adopted a framework where global equity is viewed as a single strategic asset class.

¹⁵ For more discussion on this topic, see Kang and Melas (2010).

Exhibit 27: Equity home bias in selected countries

Country	1997	2001	2004	2007	2010	2012	2016	2018
Japan	92.10%	86.10%	84.70%	85.00%	79.70%	77.70%	68.60%	69.00%
Canada	75.40%	59.70%	63.70%	66.10%	68.40%	61.90%	51.40%	46.00%
France	83.50%	69.40%	59.50%	65.20%	58.30%	55.30%	53.70%	53.60%
USA	79.00%	69.60%	59.10%	58.80%	52.80%	55.10%	45.00%	42.50%
Switzerland		57.30%	52.60%	52.10%	51.20%	50.00%	49.10%	42.20%
UK	75.90%	64.00%	56.10%	55.80%	51.60%	49.10%	40.20%	32.80%
Sweden	79.20%	51.10%	50.80%	49.80%	49.60%	45.10%	46.40%	42.90%
Germany		49.90%	43.30%	42.60%	42.00%	43.20%	39.90%	39.80%
Denmark	79.70%	56.10%	51.40%	48.10%	44.00%	39.50%	41.90%	39.20%
Finland	94.10%	74.40%	51.30%	48.90%	40.30%	28.50%	33.90%	32.30%
Norway	84.60%	50.40%	46.10%	46.70%	29.60%	25.00%	17.40%	19.40%
Netherlands	70.20%	35.40%	20.10%	11.10%	2.70%	2.90%	0.90%	-5.70%

Source: IMF (CPIS), MSCI. Home bias is defined as $1 - (\text{actual international equity allocation} / \text{market cap based international equity allocation})$.

Summary of key observations

- Global GDP growth rates stabilized in the period after the financial crisis from 2010 to 2018. According to the IMF, long term global growth rates are expected to be close to 4% p.a., and in the medium term (2019–2023) developing economies are expected to out-grow developed economies by 2-3% p.a. Current account imbalances have come down significantly since the financial crisis (end-2010 to end-2018), thereby reducing global instability risks, e.g., the risk of a contagious currency crisis.
- GDP growth in Emerging Markets was higher than in Developed Markets, but with considerable variation across countries: While China grew faster than all other countries in MSCI ACWI, growth in South Africa and Egypt was at the lower end of the scale.
- Developed economies' debt levels grew considerably in the aftermath of the financial crisis but have stabilized and are forecast to be stable in the medium-term, reducing the risk of another sovereign debt crisis in Developed Markets (according to the IMF). By contrast, developing countries' debt levels are lower, but are growing and are expected to grow further. Investors need to be alert to sovereign debt risks in Emerging Markets in the foreseeable future.
- The global trade to GDP ratio has been stable since the financial crisis (World Bank). China and the U.S. both increased their levels of economic protectionism, although their exposure to trade risk has declined in the past decade. By

contrast, the EU and the U.K.'s exposure to trade risks (including Brexit) are considerable. Investors need to stay alert to the risks of trade wars and protectionism in the foreseeable future.

- Emerging Markets' share of global book value grew continuously over the past two decades up to the end of 2018. At the same time, their share of global sales revenues increased continuously and now exceeds their share of global GDP.
- The global opportunity set as measured by the MSCI ACWI IMI was stable between 8,000 and 9,000 global securities in the past decade. The rise of Emerging Markets led to a slight decrease in average free-float market capitalization compared to total market capitalization at a global level.
- The weight of securities from Emerging Markets in MSCI ACWI IMI has increased, mainly driven by the inclusion of additional Emerging Market countries, but Emerging Markets' weight in the index has increased by less than their share of global GDP.
- Investors have become increasingly global in their asset allocation. However, investors in northern Europe are clearly ahead of North America and Japan in terms of reducing their home bias.

2. Benefits of global diversification

In section one we observed an increase in global trade and the globalization of corporates' sales over recent decades. In parallel, we observed an increasingly global capital market, as witnessed by falling home bias in asset owners' portfolios.

In the second section, we will assess how far these economic trends have affected regional correlations and diversification benefits in investment portfolios. To be precise, we first look at cross-country correlations in developed and emerging markets to identify correlation clusters that can serve as natural building blocks for regional asset allocation. Afterwards, we look at the drivers of global diversification benefits by decomposing such benefits into a regional component, a country component and a stock component. We also look at concentration risks in global equity markets, both at a country level and stock level.

Correlations between regions

A strategy for global asset allocation requires the definition of meaningful regional building blocks. Therefore, we first address the question of how to define regional building blocks: To be precise, we are looking for a regional breakdown of the global opportunity set into regional subsets of stocks that show high levels of correlations within each regional subset and lower correlations to stocks of other regional subsets.

To start with, Exhibit 28 looks at stock correlations within Developed and Emerging Markets for the past 20 years (Dec. 31, 1998 to Feb. 28, 2019). The correlation matrix has been ordered into six sub-regions: Developed Americas, Developed EMEA, Developed APAC, Emerging Americas, Emerging EMEA and Emerging APAC. Within each sub-region, countries have been ordered from highest to lowest according to their average correlation within the sub-regions. It appears that these six sub-regions formed natural correlation clusters during this 20-year study period. The only countries that were relatively uncorrelated to their respective clusters were Israel within Developed EMEA and Pakistan within Emerging APAC. For Pakistan, the low correlation with other countries in the same region was reflected in its relatively low level of economic openness: for instance, its trade to GDP ratio at end-2017 was only 25.8%, clearly below the 39% average for South Asian countries and the 58.3% average for global low-income countries.¹⁶

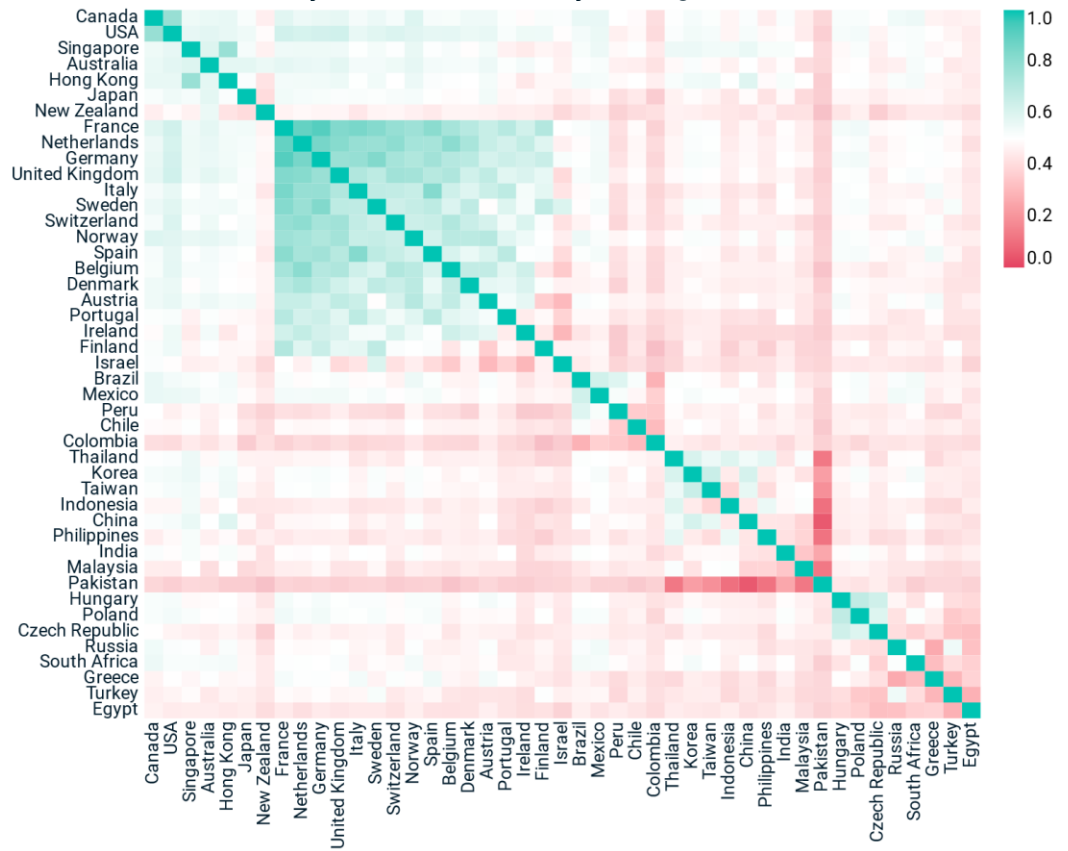
For Israel, the lower level of correlation was not surprising from an economic perspective, as it was the only country within its cluster that was not located in

¹⁶ World Bank Data and definitions per end of 2017.

Europe and that was neither member of the EU nor has formed close trade links to the EU (as Norway and Switzerland have). In fact, Israel's top trading partners¹⁷ are the U.S. and China.

However, both countries' market capitalization is fairly small compared to their respective regional clusters and therefore they do not impair the overall conclusion that developed and emerging sub-regions are natural correlation clusters that can serve as building blocks for regional asset allocation.

Exhibit 28: Global country correlation matrix by sub-regions



Source: MSCI. Data from Dec. 31, 1998 to Feb. 28, 2019.

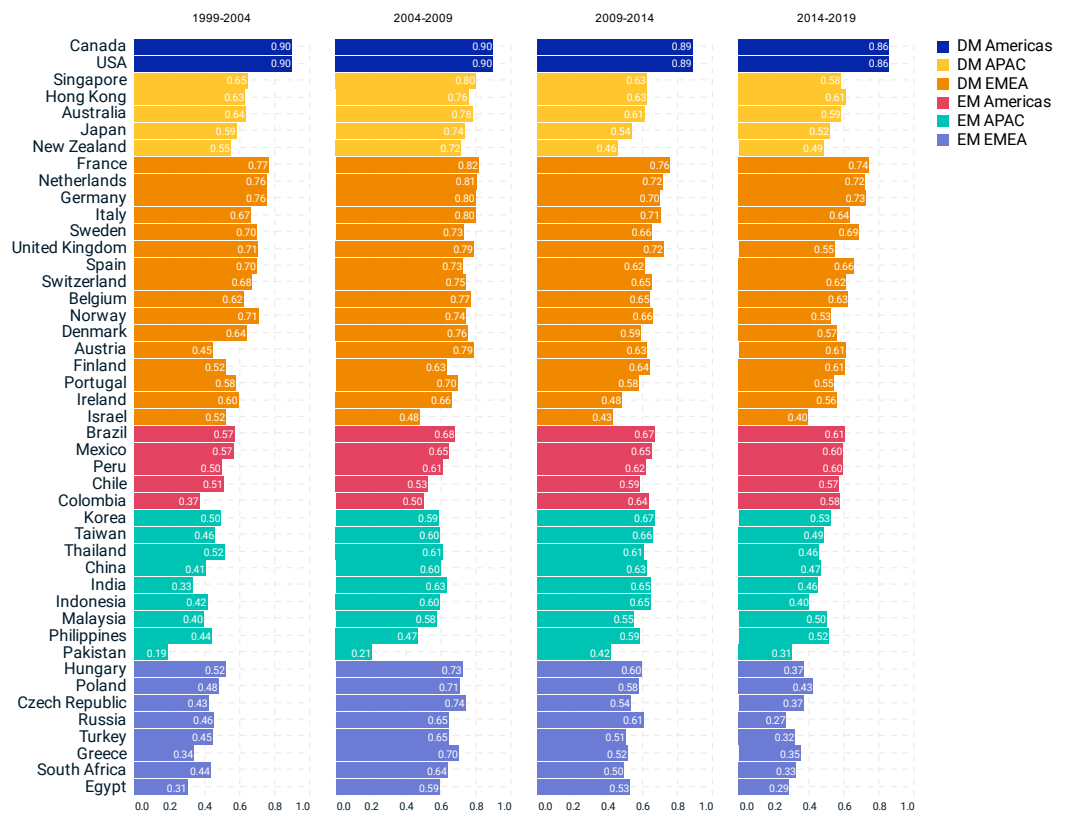
In addition, Exhibit 29 shows the average correlation of each country to other countries within the same cluster over the past 20 years. It is evident that the North American cluster was the most inter-correlated, as it just contains the U.S. and

¹⁷ <https://atlas.media.mit.edu/en/profile/country/isr/>

Canada, which are economically very closely integrated. EMEA stands in second place (despite the exception of Israel) due to the close economic integration of Developed European countries. Interestingly, Emerging Markets Europe has been the least inter-correlated regional cluster, particularly in the past five years. This reflects declining economic inter-regional dependency and increasing economic dependency on Western Europe. For instance, eight out of the top ten trading partners of Poland¹⁸ (Eastern Europe’s second largest economy after Russia) are Western European countries, with Germany alone accounting for 27.4% of Poland’s external trade.

Exhibit 29 also shows that correlations were lower in the last five years than over the last twenty. This reflects that the five-year period ending February 2019 did not see any financial distress, which usually leads to increased correlations.

Exhibit 29: Average correlations of countries within their respective cluster

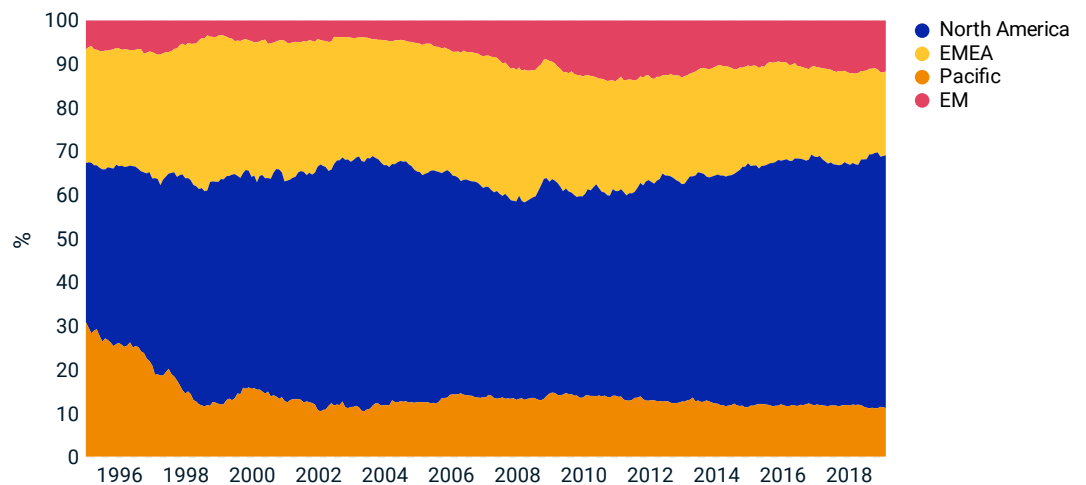


Source: MSCI. Period from Dec. 31, 1998 to Feb. 28, 2019.

¹⁸ <http://www.worldstopexports.com/polands-top-import-partners/>.

After identifying global correlation clusters, the second important step in defining the regional building blocks used for asset allocation is to assess the relative size of regional markets. The analysis in Exhibit 30 shows how regional weights became far more concentrated during the past three decades: As of the end of 2018, North America accounted for almost 60% of global free-float market capitalization, whereas the weights of EMEA and the Pacific region declined. Emerging Markets' weight increased but was still smallest among the regions. To avoid unnecessary fragmentation of the building blocks used for asset allocation, investors may choose to look at one aggregated Emerging Markets region instead of three emerging sub-regions, implying the use of North America, EMEA, Pacific and Emerging Markets as building blocks in asset allocation. As a result, these findings are in line with GPFG's definition of regional building blocks for asset allocation.

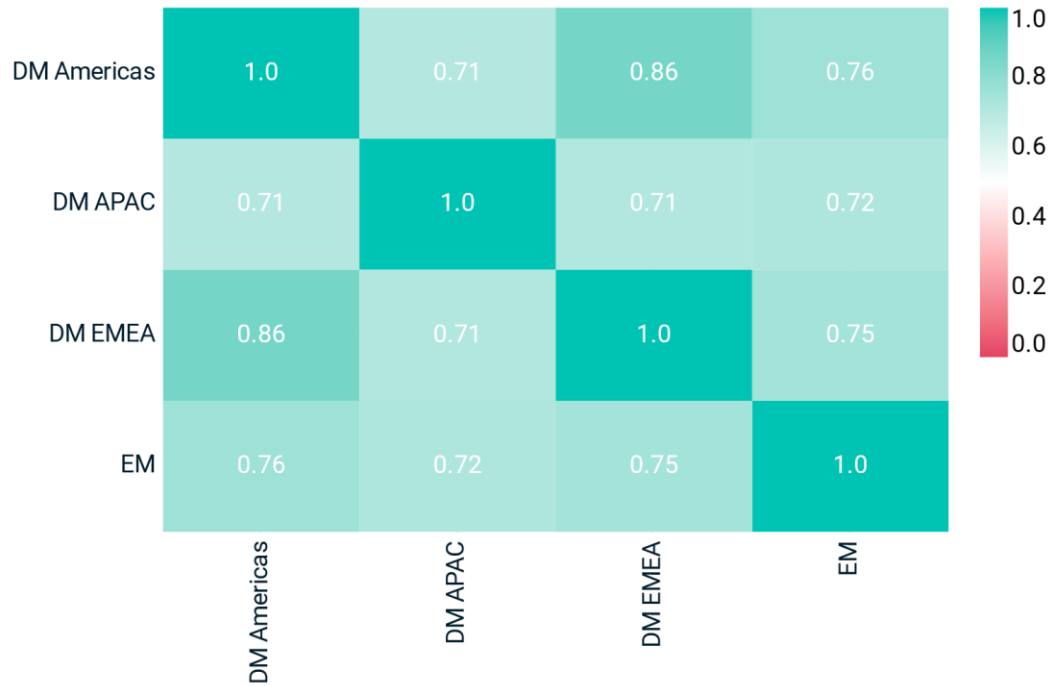
Exhibit 30: Regional distribution of weights within MSCI ACWI



Source: MSCI. Data from Dec. 31, 1994 to Feb. 28, 2019.

The logical next step is to look at the correlation structure across the four regional building blocks. In Exhibit 31 these are represented by MSCI North America, MSCI EMEA, MSCI Pacific and MSCI Emerging Markets. Most of the cross-regional correlations were between 0.7 and 0.8.

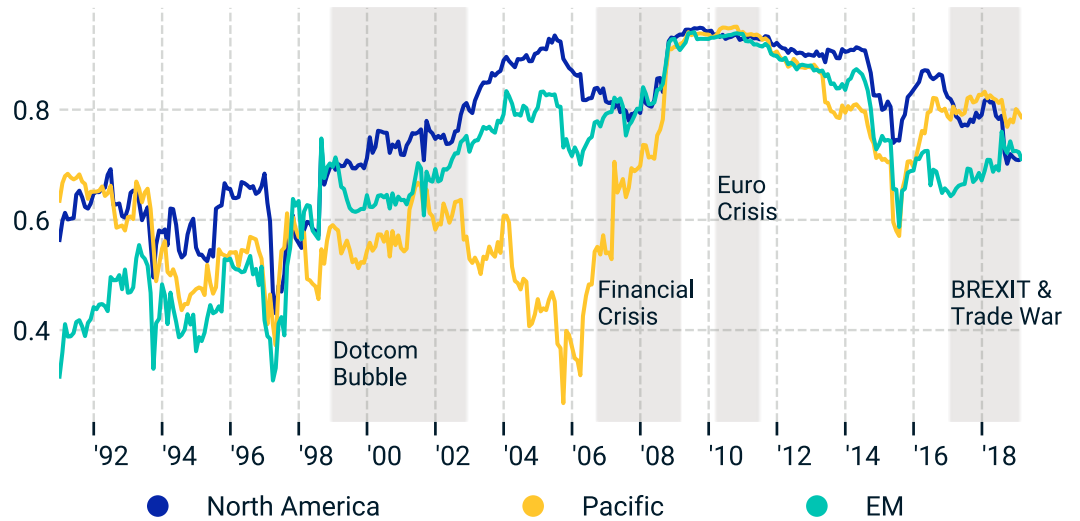
Exhibit 31: Correlation analysis of four sub-regions



Source: MSCI. Period from Dec. 31, 1998 to Feb. 28, 2019.

Exhibit 32 illustrates the correlation of North America, Pacific and Emerging Markets to EMEA. Inter-regional correlations followed a cyclical pattern: They were typically higher in times of financial distress and increased on balance over the past three decades. On average, correlations tended to be higher than in the 1990s, especially for Emerging Markets.

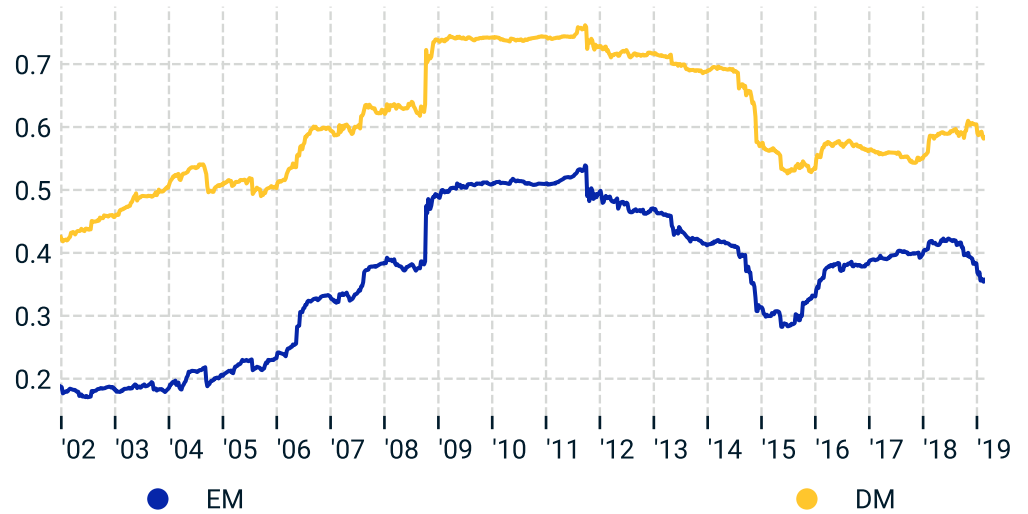
Exhibit 32: Region 36-month trailing correlation to MSCI EMEA



Source: MSCI. Period from Dec. 31, 1990 to Feb. 28, 2019.

In addition, Exhibit 33 shows the average pairwise correlation between countries within Developed Markets and Emerging Markets. It is interesting to note that while correlations in both markets showed similar cyclical behavior, overall average country correlations in Emerging Markets were lower throughout the study period than in Developed Markets.

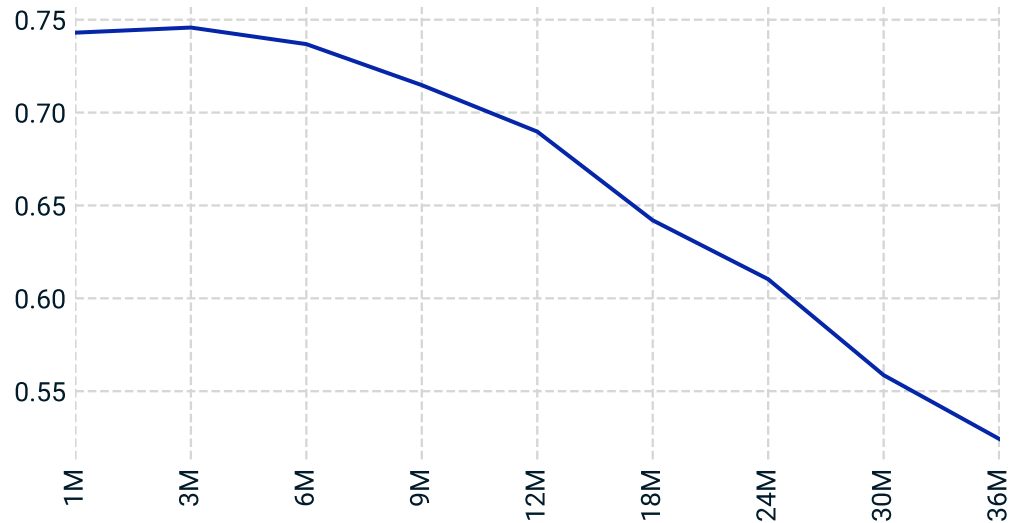
Exhibit 33: Pairwise country correlation in DM and EM



Source: MSCI. Period from Dec. 28, 2001 to Feb. 28, 2019.

However, it is important to mention that levels of correlations may also depend on the period used for measuring returns. Exhibit 34 compares the average pairwise correlation among the four regions for different holding periods used for measuring returns, i.e., from 1-month period returns to 36-months period returns. We observe that for longer holding periods the four regions were less correlated than for shorter holding periods. Consequently, the effectiveness of diversification across regions may depend on the holding period used for assessing diversification.

Exhibit 34: Average regional correlation over different holding periods



Source: MSCI. Period from Dec. 30, 1994 to Feb. 28, 2019.

Dispersion in equity markets

From an investment risk management perspective, it is important to understand how uniform or how dispersed securities’ returns were within a given universe of securities, and how far return dispersion changed across the business cycle. Therefore, we will use the concept of cross-sectional volatility of returns (CSV) as defined in Exhibit 35 as a measure of return dispersion.

Exhibit 35: Definition of cross-sectional volatility of returns (CSV profile)

The cross-sectional volatility of returns for a portfolio or index consisting of $i=1..N$ constituents with weights w_{it} at time t is defined as

$$\sigma_t = \sqrt{\sum_{i=1}^N w_{it}(r_{it} - \bar{r}_t)^2}$$

With securities’ previous month return r_{it} and the average portfolio return at time t defined as $\bar{r}_t = \sum_{i=1}^N w_{it}r_{it}$.

To limit noise, the final CSV profile at time T as calculated in this report is the 12-month moving average of monthly cross-sectional volatility of returns:

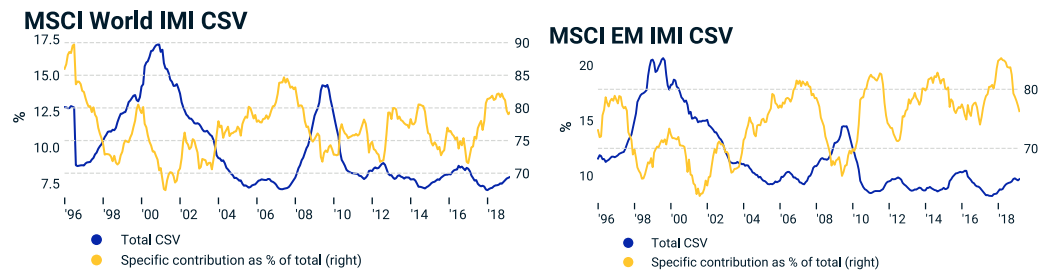
$$CSV(T) = \frac{1}{12} \sum_{t=T-11}^T \sigma_t$$

The CSV profile can be further broken down into contributions from countries, industries, equity style factors and stock specific contributions, using the MSCI GEMLT model as shown in Menchero and Morozov (2011).

Another way of looking at CSV profiles is to assess how much diversification potential there is in a universe of securities: When dispersion is low (i.e., all securities move in parallel), there is little diversification potential.

Exhibit 36 shows the dispersion of equity returns as measured by their cross-sectional volatility. For the sake of simplicity, we focus the analysis on DM and EM markets. The CSV profile in each region followed the equity market cycle very closely, so that in turbulent markets there was more dispersion in returns than in calm markets. Overall, stock return dispersion was higher in Emerging Markets than in Developed Market regions. At the same time, in both regions the majority (65-90%) of CSV was explained by stock specific return contributions. It is interesting to note that stock specific dispersion was lowest during times of financial distress, in line with the increased levels of correlations among stocks during turbulent markets, as discussed above.

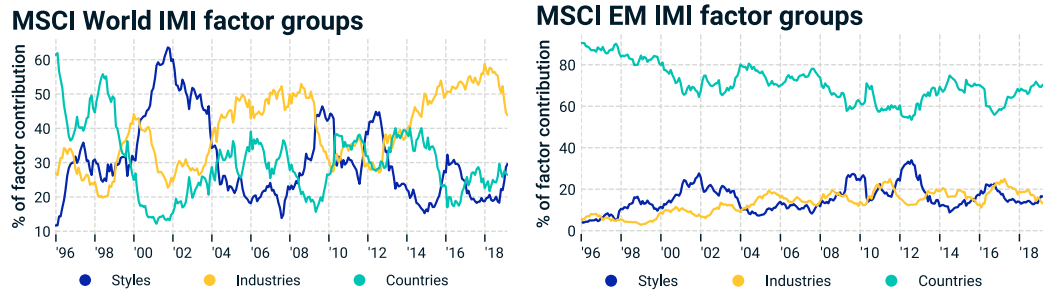
Exhibit 36: CSV profiles of DM and EM



Source: MSCI. Data from Dec. 29, 1995 to Feb. 28, 2019.

The next question is what has been driving the systematic part of CSV in DM and EM. Exhibit 37 shows a breakdown of the contributions to CSV into countries, industries and equity style factors. The contribution from countries was very different across the regions: it was relatively small in Developed Markets, while it was the dominant driver in Emerging Markets. This means that diversification across countries was most important for diversifying risks in Emerging Markets. In addition, contributions from equity style factors were most prominent in times of financial distress, i.e., when the dot-com bubble burst and during the financial crisis. This means that stocks with varying exposures to style factors performed most differently when markets were turbulent.

Exhibit 37: Contributions to CSV in DM and EM



Source: MSCI. Data from Dec. 29, 1995 to Feb. 28, 2019.

Diversification benefits

To assess diversification benefits in global equities and the contribution of regions and countries to diversification, we use the concept of the diversification ratio, as explained in Exhibit 38.

Exhibit 38: Definition of diversification ratio

The diversification ratio of a set of securities measures the ratio between the weighted sum of the individual security volatilities (using portfolio weights in the sum) and the volatility of the entire portfolio:

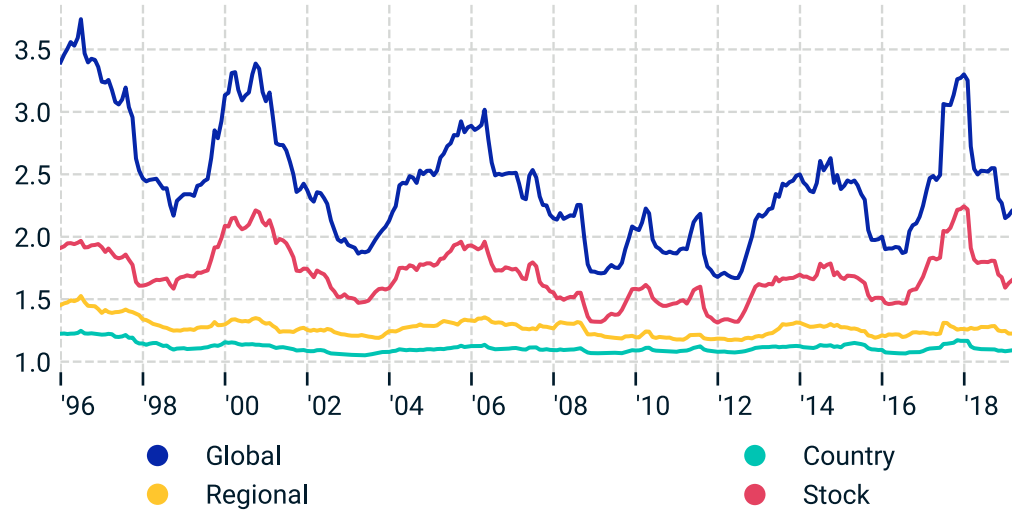
$$\text{Diversification ratio} = \frac{\text{wgt av stock risk}}{\text{total portfolio risk}}$$

The diversification ratio can be broken down into regional, country and stock contributions to the global diversification ratio (see Appendix):

$$\text{Diversification ratio} = \frac{\text{wgt av stock risk}}{\text{wgt av country risk}} \times \frac{\text{wgt av country risk}}{\text{wgt av region risk}} \times \frac{\text{wgt av region risk}}{\text{total portfolio risk}}$$

Exhibit 39 shows the diversification ratio with a breakdown into contributions from regions, countries and stock components. In section seven of this report we will also assess sectoral contributions to the global diversification ratio.

Exhibit 39: Diversification ratio of MSCI ACWI



Source: MSCI. Period from Dec. 29, 1995 to Feb. 28, 2019.

The overall diversification ratio showed similar cyclical behavior as the aforementioned correlation analysis: Diversification benefits were typically higher in calm markets and lower in distressed markets, when stocks tended to move downwards simultaneously. Stock diversification was the largest contributor to diversification, followed by regional diversification and country contribution, which was the smallest contributor. Exhibit 40 compares regional and country contributions to the overall diversification ratio: we observed a slight decrease in the effectiveness of regional diversification during the study period, which is in line with the afore-mentioned observation that inter-regional correlations were increasing during the study period.

Exhibit 40: Diversification ratio of MSCI ACWI – regional and country contributions



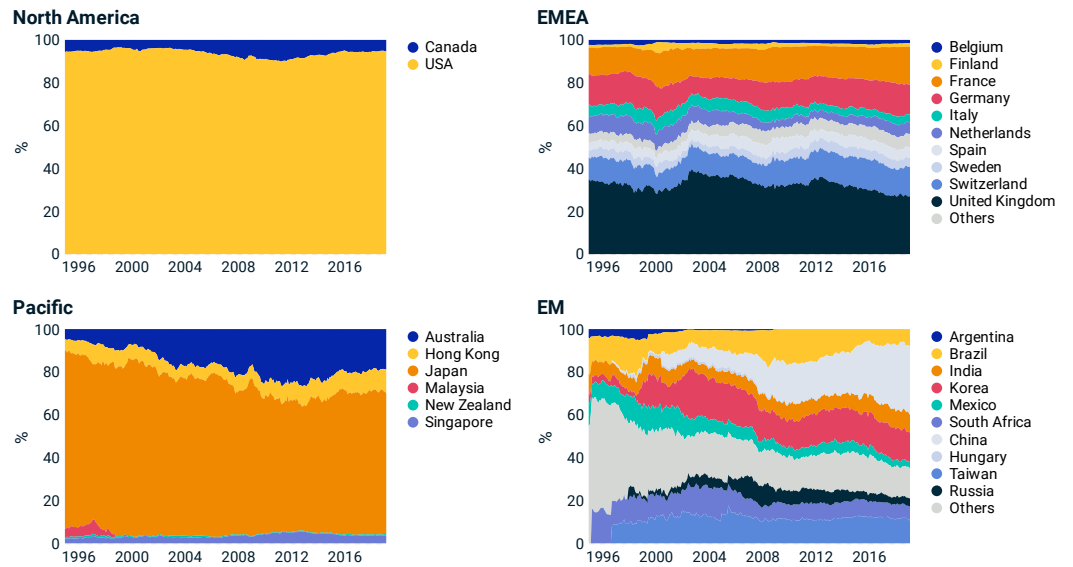
Source: MSCI. Period from Dec. 29, 1995 to Feb. 28, 2019.

This means that the four regions have been meaningful regional building blocks for achieving diversification benefits. However, for each of these building blocks, diversification across countries contributed relatively little to global diversification.

An examination of the country composition of the four regions explains the lower level of country diversification (Exhibit 41): The four sub-regions were highly concentrated, with North America and Pacific each dominated by one country (U.S. and Japan respectively). Even in EMEA, index performance was dominated by the U.K., France, Germany and Switzerland, which were relatively highly correlated markets due to the close economic integration of the European economy (Exhibit 28). In addition, Emerging Markets were increasingly dominated by China.

In section seven of this report, we will study the contribution of sectors to the global diversification ratio.

Exhibit 41: Country composition of regional markets



Source: MSCI. Period from Dec. 30, 1994 to Feb. 28, 2019.

Portfolio concentration risk and mega-caps

Concentration risk is an important dimension of risk for institutional investors. To assess portfolio concentration risks, we will use the concentration risk measures defined in Exhibit 42.

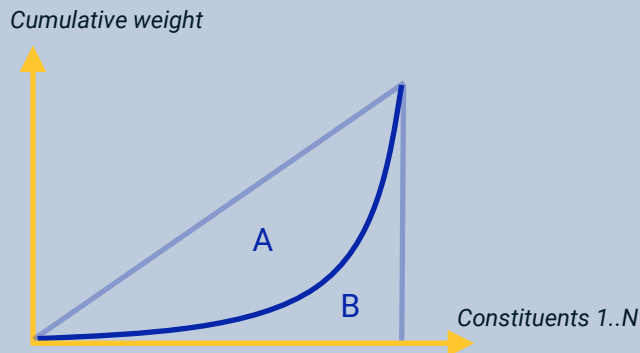
Exhibit 42: Definition of measures for portfolio concentration risk

We consider a portfolio or index consisting of $i=1..N$ constituents with weights w_{it} at time t and $\sum_{i=1}^N w_{it}=1$.

The **effective number of stocks ES** is a standard measure for portfolio diversification and is calculated as

$$ES(t) = \frac{1}{\sum_{i=1}^N w_{it}^2}$$

Assuming the portfolio weights $i=1..N$ are sorted from the smallest to the largest weight, the **Lorenz curve** shows the cumulative portfolio weight over the cumulative number of portfolio constituents:



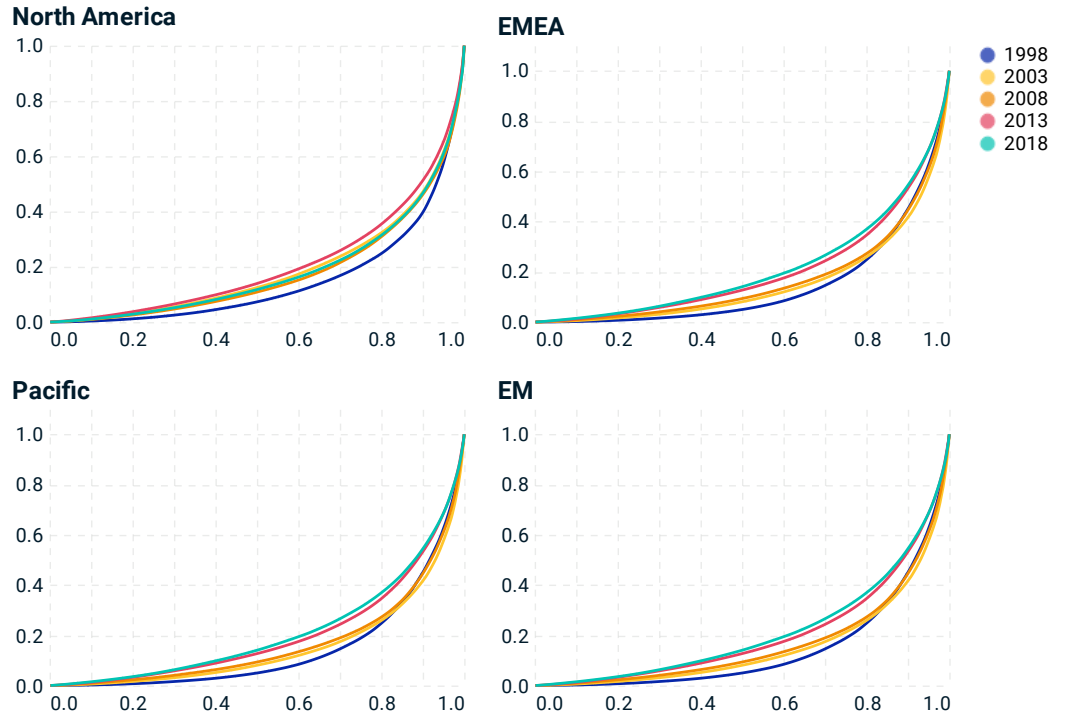
The **Gini coefficient** is a standard measure for portfolio concentration and is defined as the ratio of the areas B and A+B:

$$Gini = \frac{B}{A + B}$$

Exhibit 43 assesses the evolution of portfolio concentration risk in the Developed and Emerging Markets regions during the past two decades. For all four regions, the Lorenz curve was slightly flatter as of end-2018 than 20 years ago, indicating that overall these indexes have become less concentrated. This was also visible in the slight decrease in the Gini coefficient compared to 20 years ago (Exhibit 44). In Emerging Markets, the improvement in concentration risk over the past 20 years was not quite as clear as in Developed Markets, and slightly reversed during the past

decade. Concentration in the largest stocks increased, as measured by the steepness of the curve at the right-hand end of the scale.

Exhibit 43: Lorenz concentration curves for regional markets



Source: MSCI.

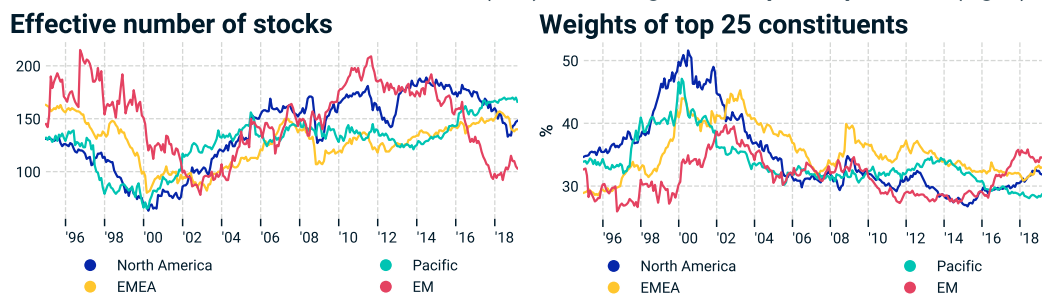
Exhibit 44: Gini coefficients for regional markets

Portfolio	North America	EMEA	Pacific	EM
1998	0.61	0.67	0.6	0.64
2003	0.53	0.59	0.55	0.58
2008	0.55	0.57	0.53	0.53
2013	0.52	0.54	0.52	0.51
2018	0.54	0.53	0.51	0.59

Source: MSCI.

Investigating deeper, we look at regional concentration risks (Exhibit 45). North America and Emerging Markets (to an even greater extent) saw a drop in the effective number of stocks over the last five years, while EMEA and the Pacific region saw a slight increase in diversification. The weight of the top 10 and 25 components in each regional benchmark confirms the slight increase in portfolio concentration in Emerging Markets and North America. As detailed below, rising portfolio concentration in North America and Emerging Markets was largely due to the emergence of FAANG and BAT stocks.

Exhibit 45: Effective number of stocks (left) and weights of top components (right)



Source: MSCI. Period from Dec. 30, 1994 to Feb. 28, 2019.

The risk of mega-caps: FAANG and BAT stocks

FAANG (Facebook, Apple, Amazon, Netflix, Google) and BAT stocks (Baidu, Alibaba, Tencent) contributed significantly to global equity returns over the last five years (Exhibit 46).

Exhibit 46: Performance of FAANG in MSCI USA and BAT in MSCI China

Metrics	USA	USA ex FAANG	China	China ex BAT
Total return (%)	10.54%	9.56%	8.76%	6%

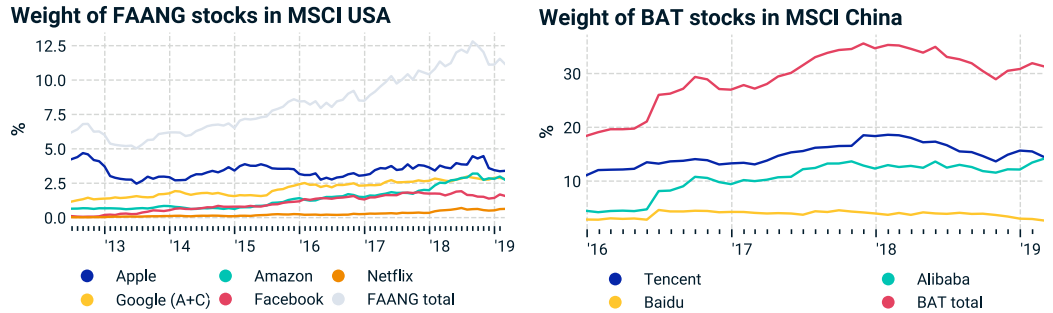
Source: MSCI. Data from Feb. 28, 2014 to Feb. 28, 2019.

At the same time, they significantly increased concentration risks in their respective markets. Exhibit 47 shows that the weight of FAANG stocks in the MSCI USA Index doubled during the last five years and in parallel the average pairwise correlation of FAANG stocks more than tripled, from about 0.22 to over 0.77 (Exhibit 48). Likewise, the weight of BAT stocks in MSCI China almost doubled in the last three years to exceed 30%, while their pairwise return correlations increased significantly.

In addition, the relative valuation level of FAANG stocks remained high at between three and five times the price-to-book value of the benchmark. Analogously, BAT stocks' valuation level was 4-6 times higher than the Chinese market. All in all, FAANG and BAT stocks became relatively expensive, highly concentrated and highly correlated.

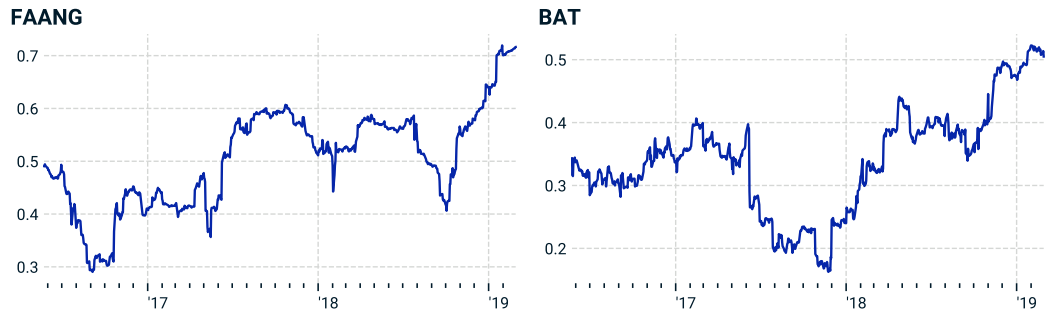
It is also important to highlight the sheer size of these firms: Apple and Amazon were the first companies to reach a market capitalization of above 1 trillion USD, about 2.5 times the GDP of Norway. Alibaba reached a market capitalization of about 400 billion USD at end-2018, slightly above Norway's GDP. In other words, the corporate risks investors in these companies face have reached an almost macro-economic level – even more so when taking into account the increasing levels of correlation between them.

Exhibit 47: Weight of FAANG in the MSCI USA Index (left) and BAT in the MSCI China Index (right)



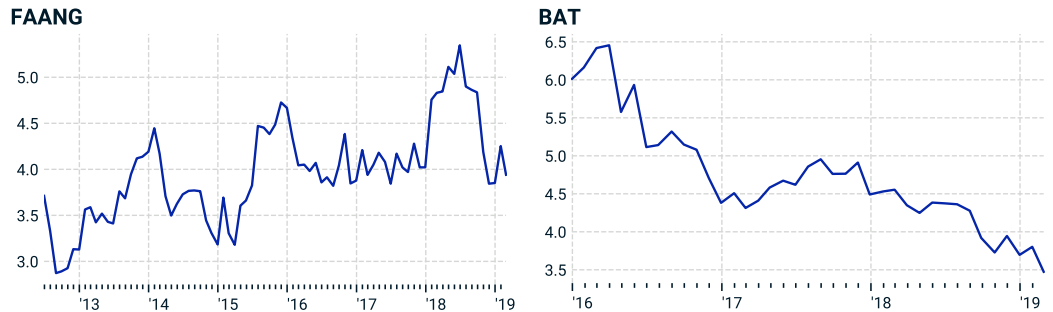
Source: MSCI. Period from Jun. 29, 2012 to Feb. 29, 2019.

Exhibit 48: Average pairwise rolling 126 days return correlation for FAANG and BAT stocks



Source: MSCI. Period from Jun. 29, 2012 to Feb. 29, 2019.

Exhibit 49: Relative price-to-book of FAANG stocks to the MSCI USA Index and BAT stocks to the MSCI China Index



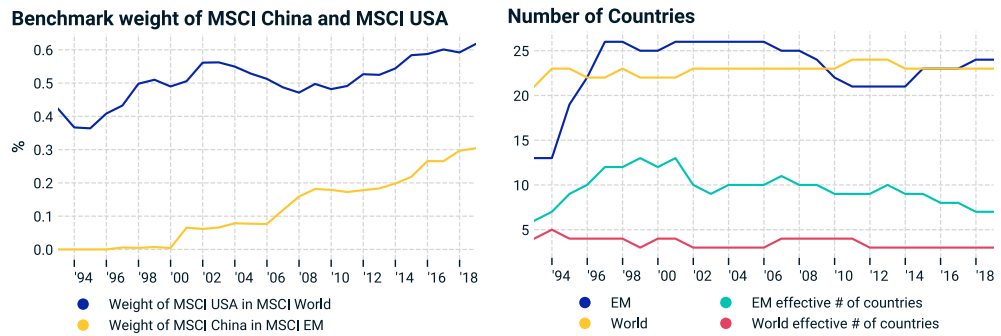
Source: MSCI. Period from Jun. 29, 2012 to Feb. 29, 2019.

These results confirm the afore-mentioned finding that concentration risks increased in both Developed Markets and Emerging Markets during the last decade.

Country concentration risk

Another important driver of concentration is country risk. Exhibit 50 explores the evolution of the weight of the U.S. in Developed Markets and of China in Emerging Markets, as well as the effective number of countries in both markets. In fact, both regions showed a continuous and significant increase in country concentration risk over the last two decades, with the U.S. and China dominating their respective regions.

Exhibit 50: Weight of China and USA in MSCI EM and World indexes



Source: MSCI. Period from Dec. 31, 1992 to Dec. 31, 2018. Annual data.

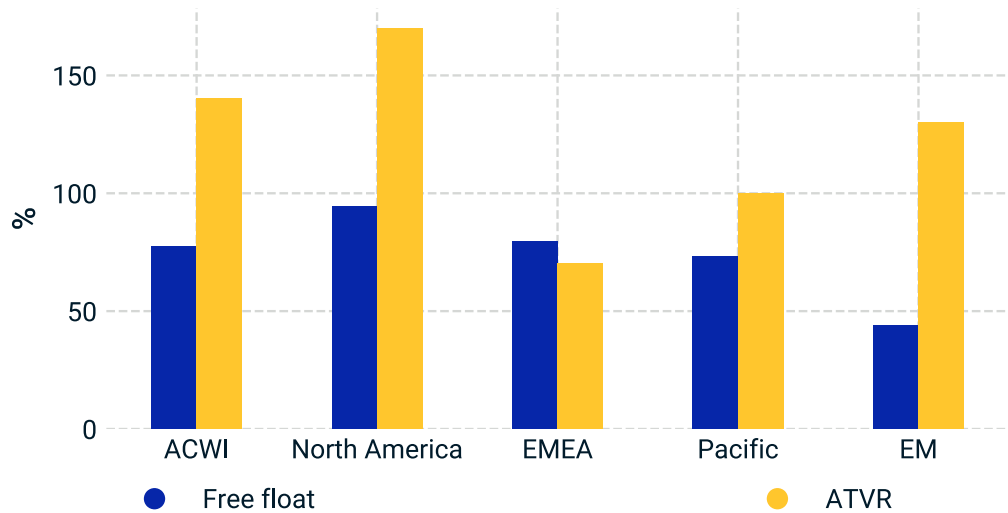
All in all, the U.S. and China have been the main sources of increasing levels of country concentration risk, while they were also (via FAANG stocks in the U.S. and BAT stocks in China) the main contributors to increasing levels of concentration risk.

Free-float and liquidity profiles

Investors allocating capital in global equity markets are often concerned about market openness and liquidity. The analysis in Exhibit 51 uses the average free-float percentage of total market capitalization as a proxy for market openness and the

average traded volume ratio (ATVR¹⁹) as a measure of market liquidity. North America is the most liquid market as trading volumes here are higher, while MSCI’s measure for trading volumes combines multiple exchanges in North America for the same security. Interestingly, Europe is the region with the lowest level of liquidity. In terms of average free-float, Emerging Markets clearly show lower levels than Developed Markets, indicating less open markets.

Exhibit 51: Average free-float and average trading volume ratio (ATVR) by region



Source: MSCI. Data as of Feb. 28, 2019.

Summary of key observations

- Countries in MSCI ACWI sub-regions (North America, EMEA, Pacific and Emerging Markets) have shown strong average intra-regional equity return correlation and therefore form natural regional building blocks for asset allocators. Correlations followed the cyclical behavior of the market – they were typically higher in times of market stress.

¹⁹ The Annualized Traded Value Ratio (ATVR) used in this report is used to assess the liquidity of securities in benchmarks. ATVR corresponds to the annualized traded value of a security relative to its free float - adjusted market capitalization.

- Since the 1990s, average correlation levels have slightly increased, but without a visible impact on the effectiveness of risk diversification through EM exposure for DM investors.
- The scope for cross-regional diversification decreased over the past decades due to the growing dominance of North America. In addition, country diversification decreased in all regions due a clear increase in country concentration.
- Diversification benefits within and across regions followed similar patterns as correlations: In times of market stress, diversification benefits were significantly lower due to higher levels of correlation.
- The scope for regional diversification decreased in the last decade due to the increasing weight of North America. At the same time, the scope for country diversification decreased as well, with North America, Pacific and Emerging Markets being increasingly dominated by large countries. However, the scope for stock diversification – the largest contributor to global diversification – is still intact, having slightly increased during the past decade.
- The EM portfolio concentration risk increased slightly in the last decade, despite an increase in the number of countries and constituents. A key driver was the rise of mega-caps such as FAANG stocks in DM and BAT stocks in EM. Country concentration risk rose in DM due to the effect of the U.S. market and in EM due to the impact of China. Investors need to be aware of concentration risks in the foreseeable future and may decide to mitigate them by defining appropriate exposure limits.
- Our analysis of mega-caps (FAANG in the U.S. and BAT in China) indicates that these groups of stocks have shown increasing levels of market capitalization and weight in their benchmarks, increasing levels of inter-group correlations and high valuation levels compared to benchmark. This makes them a risk factor that global investors should reckon with.

3. Equity returns and fundamental drivers

In section three of this report, we look at the historical stock performance and risk profile of global and regional equity markets. The key question we address is how far differences in regional equity performance can be explained by differences in economic trends (GDP growth, corporate sales growth) or by differences in market fundamentals, i.e., differences in profitability, earnings growth and valuation levels. In addition, we look at how far the contribution of fundamental drivers differed over different time periods. We also decompose historical country equity risk premia to assess how far equity investors have been compensated for investing in smaller, less liquid and less developed markets.

Historical returns

Exhibit 52 shows the historical performance of Developed Markets and Emerging Markets. Since the launch of the MSCI Emerging Markets Index (end of 1987) until the end of February 2019, Emerging Markets have outperformed Developed Markets, albeit with substantially higher levels of financial risk (volatility, Value-at-Risk and drawdowns). The performance of Developed Markets was very close to the overall MSCI ACWI benchmark, since most of the equity exposure in the global benchmark was from Developed Markets.

Exhibit 52: Performance and risk overview of Developed and Emerging Markets

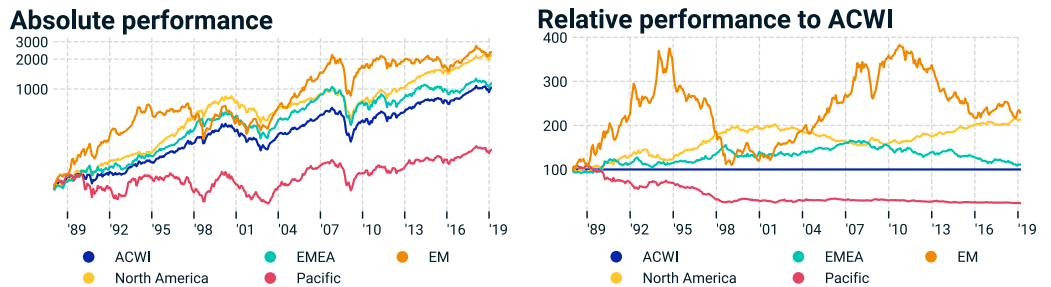
Metrics	ACWI	World	EM
Full period return (%)	7.8	7.8	10.7
5 Yr (%)	6.9	7.1	4.5
10 Yr (%)	13.3	13.7	10.7
Sharpe ratio	0.29	0.29	0.32
Volatility	14.8	14.6	22.5
VaR @ 99%	-10.6	-10.6	-15.7
CVaR @ 99%	-14.3	-13.8	-22.5
Max drawdown (%)	-54.6	-53.7	-61.4

Source: MSCI. Data from Dec. 31, 1987 to Feb. 28, 2019. Performance is annualized.

In addition, Exhibit 53 looks at the absolute historical performance of the four global regions and their performance relative to MSCI ACWI. The Emerging Markets region showed the strongest overall performance differential compared to the global

benchmark with two performance super-cycles – the first in the mid-1990s and the second in the run-up to the financial crisis. The Asian crisis and the financial crisis marked the end of these super-cycles. It is interesting to note that the MSCI EM Index doubled in value during the decade ending 2008, despite the financial crisis, showing strong outperformance over Developed Markets for this period. However, after the financial crisis, Emerging Markets equities saw a relatively short recovery period up to 2010, when they entered a phase of eight years of underperformance versus Developed Markets until the end of 2018. EMEA and Pacific outperformed North America in the run-up to the financial crisis in 2008, leading to larger relative drawdowns during the crisis. Following the trough of the crisis, North America outperformed all other regions considerably.

Exhibit 53: Absolute and relative performance of regional markets



Source: MSCI. Data from Dec. 31, 1987 to Feb. 28, 2019.

Over the past two decades, the difference in financial performance is also evident when looking at risk figures (Exhibit 54): North America showed lower levels of risk (volatility, Value-at-Risk and drawdowns) than all other global regions, especially compared to Emerging Markets, which was the riskiest region by all risk measures. Within Developed Markets, EMEA showed the highest level of risk, while Pacific delivered the lowest levels of returns during the study period. It is also interesting to note that throughout the study period North America showed the highest risk-adjusted returns (Sharpe-ratio), due to lower levels of risk compared to Emerging Markets.

Exhibit 54: Performance and risk overview

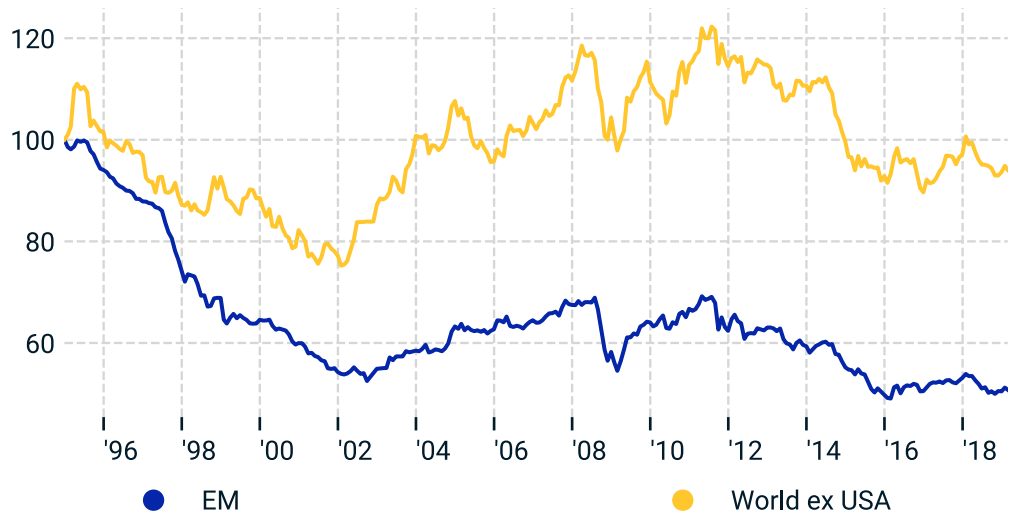
Metrics	ACWI	North America	EMEA	Pacific	EM
Full period return (%)	7.8	10.4	8.1	2.9	10.7
5 Yr (%)	6.9	10.0	1.3	5.1	4.5
10 Yr (%)	13.3	16.1	10.3	9.8	10.7
Sharpe ratio	0.287	0.486	0.271	-0.034	0.318
Volatility	14.8	14.2	17.0	18.9	22.5
VaR @ 99%	-10.6	-9.7	-12.2	-13.3	-15.7
CVaR @ 99%	-14.3	-13.4	-15.5	-16.4	-22.5
Max drawdown (%)	-54.6	-51.1	-59.0	-52.2	-61.4

Source: MSCI. Data from Dec. 31, 1987 to Feb. 28, 2019. Performances are annualized.

The different cyclical behavior of Developed Markets versus Emerging Markets during the past two decades provides evidence for the added value that Emerging Market equities have offered investors for diversifying their global investments.

To probe deeper into these differences, we first look at currency performance (Exhibit 55). Emerging Markets currencies underperformed both USD and other Developed Markets currencies during the study period. Underperformance was greater during the first half of the study period, due to the Asian crisis, but even during the past decade EM currencies continued to underperform. Therefore, the underperformance of Emerging Markets equities in USD terms during the second half of the study period was partly explained by currency effects.

Exhibit 55: Currency returns of MSCI World ex USA and MSCI EM Indexes in USD²⁰



Source: MSCI. Data from Dec. 30, 1994 to Feb. 28, 2019.

Equity returns and the business cycle

To probe further into differences between Developed and Emerging Markets, we assess DM and EM performance correlations with the economic business cycle. We use the OECD’s Composite Leading Indicator²¹ (CLI) and inflation, measured as the change in the OECD All Items consumer price index (CPI), as indicators for the business cycle. In detail, we divide history into separate periods during which CLI and CPI were either rising or falling, and analyze the average performance in both market phases.

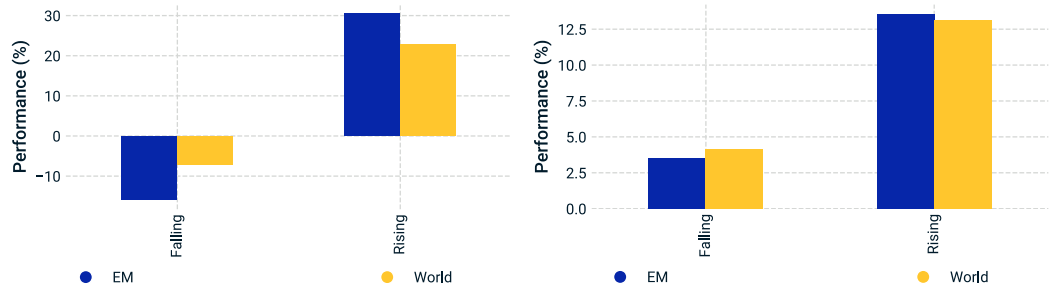
The results are intuitive (Exhibit 56): In times of economic expansion (rising CLI and CPI), average annualized performance was high in both DM and EM. By contrast, in times of falling CLI, equity markets fell on average. We also observed a clear

²⁰ The series shown in the chart are constructed by dividing the performance of the respective index in USD by its local currency variant. The local currency index variant is calculated using the return in local currency of each security, based on the same index weights as the index in USD. A falling ratio of USD versus the local index version indicates a strengthening of USD versus the index-weighted basket of currencies.

²¹ The composite leading indicator (CLI) is designed to provide early signals of turning points in business cycles by showing fluctuations of economic activity around its long-term potential level. Fluctuations in economic activity are measured as the variation in economic output relative to its long-term potential.

difference between EM and DM in terms the cyclical of equity returns: EM equity returns were clearly more cyclical across the macro-economic cycle than DM returns.

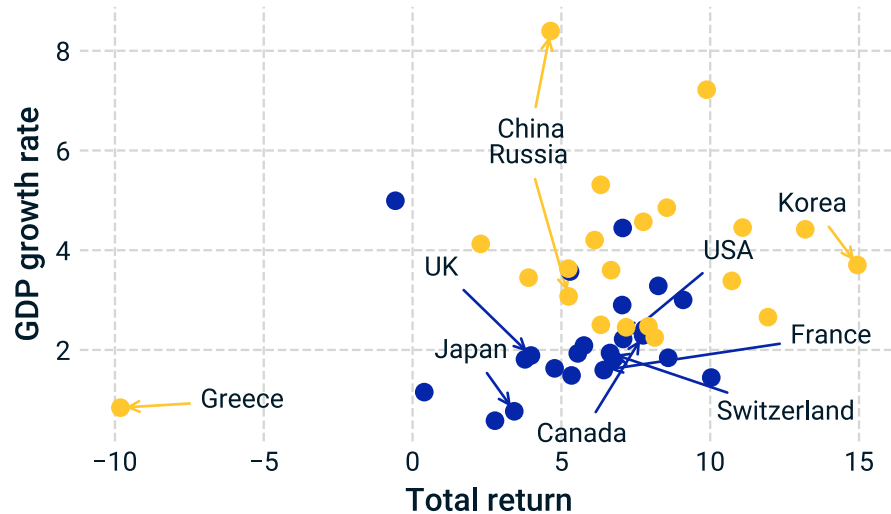
Exhibit 56: Financial performance when CLI (left) and CPI (right) fall or rise



Source: MSCI. Data from Dec. 30, 1994 to Feb. 28, 2019.

A question directly linked to the assessment of equity returns across the business cycle is how far differences in equity returns can be explained by differences in GDP growth. Therefore, Exhibit 57 compares countries' average GDP growth rates to their stock performance during the study period. Although overall average GDP growth rates and equity returns have been higher in Emerging Markets than in Developed Markets, the high level of dispersion in both economic growth and stock performance across countries meant that there was hardly any correlation between economic growth and stock performance by country. In other words, during the study period GDP growth was not a strong indicator for stock market returns.

Exhibit 57: Financial performance versus GDP growth



Source: MSCI. Data from Dec. 31, 1997 to Feb. 28, 2019.

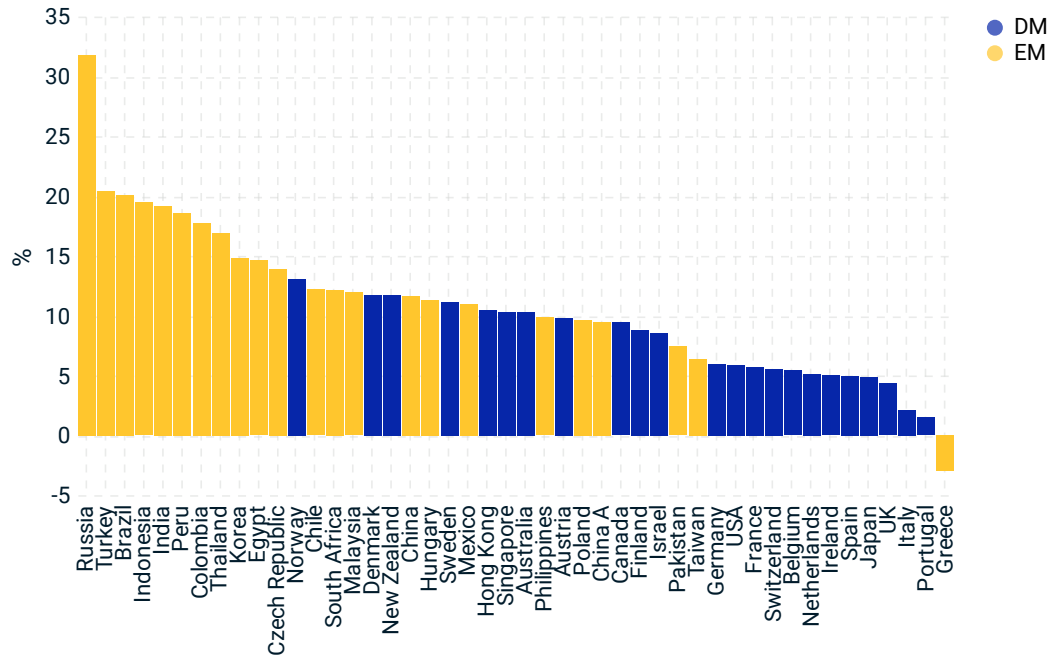
Expected returns and country equity risk premia

The next step in understanding regional differences in performance is to assess how far they can be explained by the concept of an equity risk premium that compensates investors for taking on equity price risk. This is especially important when constructing a benchmark for Emerging Markets, where investors typically face higher levels of political and governance risks.

Therefore, we calculate the historical equity risk premium for each country in MSCI ACWI²² as the historical return in USD over US Treasury yields during the past two decades. The results in Exhibit 58 confirm the previous finding that Emerging Markets countries on average outperformed Developed Markets, leading to higher equity risk premia. At the same time, Emerging Markets showed a high level of dispersion in equity risk premia, with Greece at the bottom of the table. It is worth noting that Russia is at the top of the table, as the beginning of the study period coincided with a trough in the Russian equity market and the Russian ruble.

²² We use the set of countries in MSCI ACWI as of June 2019.

Exhibit 58: Equity risk premium of countries in MSCI ACWI



Source: MSCI. Data from Dec. 31, 1999 to Dec. 31, 2018.

The most important issue is how far the equity risk premium can be explained by systematic drivers reflecting the political risk of a country, the level of capital market sophistication and the level of market governance.

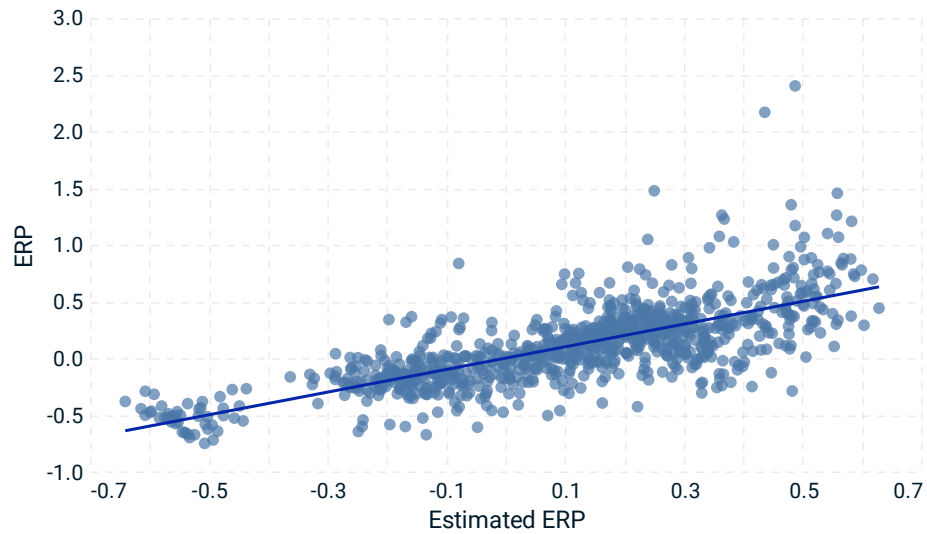
To address this, we regress the observed country equity risk premia over the global equity risk premium (MSCI ACWI), the log of the total market capitalization of each market, the liquidity of each market and the country risk as measured by the aggregated World Bank Worldwide Governance Indicator score.²³ Details of the regression can be found in the Appendix. Economically speaking, the governance score is used as a proxy for country risk, whereas market size and liquidity are used to measure the level of sophistication of each market.

The results of the regression analysis are shown Exhibit 59, with the regression coefficients and their statistical significance in Exhibit 60: The most significant regression factor was the global equity risk premium, which confirms our

²³ We use the average of the Worldwide governance inductors (WGI): Voice and Accountability, Political Stability and Absence of Violence, Government Effectiveness, Regulatory Quality, Rule of Law and Control of Corruption.

observation from section two of this report that global equity markets have been highly correlated.

Exhibit 59: Historical vs regressed equity risk premium per country*



*Country risk premium = $0.06 + (1.27 * ACWI\ IMI\ ERP) + (-0.04 * Mcap) + (-0.02 * WB\ governance\ score) + (-0.1 * Liquidity)$.

*R-Square = 0.605

Source: MSCI, World Bank. Data from Dec. 31, 1999 to Dec. 31, 2018.

Next, we observe that both market size and market liquidity showed a negative regression coefficient (Exhibit 60), which was economically consistent with the concept of a premium compensating investors for taking market risk: Small and less liquid markets are typically less sophisticated, and therefore market participants expect a risk premium to compensate them for the additional level of risk compared to more sophisticated markets. We also tested the regression coefficients over different time horizons (10-year sub-periods) to validate the robustness of the regression results.

Exhibit 60: Regression coefficients

Results	Coefficients	P > t
Intercept	0.05597	0.0
ACWI IMI ERP	1.26759	0.0
Mcap	-0.04342	0.0
WB governance score	-0.02254	0.03535
Liquidity	-0.10426	0.00323

Source: MSCI, World Bank.

Interestingly, including the country governance score added explanatory power to the regression model with a negative coefficient, showing that low governance scores were compensated by an additional risk premium not reflected in the size and liquidity factors.

All in all, equity risk premia were higher in Emerging Markets than Developed Markets, compensating investors for higher levels of risk in terms of business cyclicity and market price volatility.

Fundamental drivers of returns

Next, we want to gain an understanding of the fundamental drivers of regional performance differences in terms of profitability and equity valuation measures.

We focus on the time period from end of December 1994 to end of February 2019, for which fundamental data was available. The corresponding risk and performance characteristics are summarized in Exhibit 61.

Exhibit 61: Performance and risk overview

Metrics	ACWI	North America	EMEA	Pacific	EM
Full period return (%)	7.4	9.8	7.2	2.7	5.8
5 Yr (%)	6.9	10.0	1.3	5.1	4.5
10 Yr (%)	13.3	16.1	10.3	9.8	10.7
Sharpe ratio	0.311	0.479	0.262	-0.003	0.139
Volatility	15.0	14.8	17.3	16.9	22.4
VaR @ 99%	-11.1	-10.2	-12.6	-11.8	-16.5
CVaR @ 99%	-15.4	-14.4	-16.5	-14.3	-24.6
Max drawdown (%)	-54.6	-51.1	-59.0	-52.2	-61.4

Source: MSCI. Data from Dec. 30, 1994 to Feb. 28, 2019.

Exhibit 62 provides an overview of fundamentals for this study period. Profitability, as measured by return on equity (RoE), has shown cyclical behavior in line with the overall business cycle, with a large drop in profitability during the financial crisis. Throughout the study period, North America was the most profitable region, with Pacific the least profitable. However, over the last two decades we saw declining regional differences in profitability, and therefore RoE ratios converged to a degree, especially during the last five years. In addition, the profitability of Emerging Markets, which was initially below that of Developed Markets, caught up and is now at the same level.

Looking at price-to-earnings ratios, Emerging Markets saw the lowest earnings multiples throughout the study period. Pacific saw a significant and continuous decline in P/E ratios in the past two decades, mainly due to the Japanese equity market. Overall, P/E ratios across the four regions converged to reach very similar valuations levels in 2012, their trough in the aftermath of the financial crisis. Afterwards, valuation levels rebounded and also started to diverge: North America witnessed the strongest increase in valuation levels during the last six years, while Pacific and Emerging Markets only saw small changes in valuations.

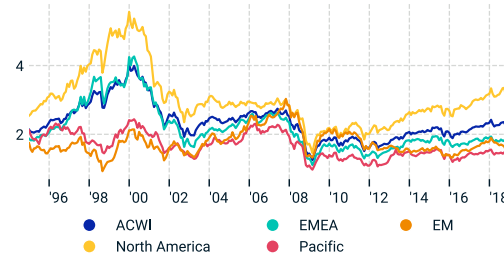
The divergence in regional valuation levels was even more evident when looking at price-to-book ("PB") ratios: PB ratios across the four regions converged until the peak of the financial crisis in 2009. In the decade before the financial crisis, North America had seen a substantial decline in PB ratios due to the burst of the dotcom bubble. After 2009, PB ratios started to diverge again, with North American valuation levels

expanding beyond all other regions and Pacific and Emerging Markets lagging behind.

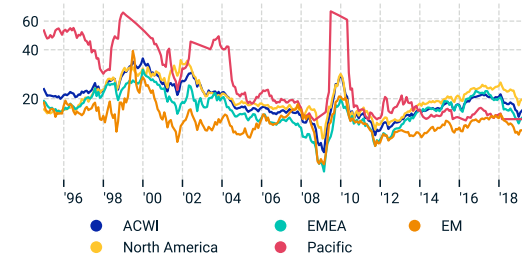
At the same time, higher valuation levels in North America led to relatively lower dividend yields than in all other regions. Emerging Markets showed the second highest level of profitability during the last decade, but this did not lead to a corresponding increase in valuations compared to EMEA or the Pacific region. It seems that the higher levels of risk shown in Exhibit 54 also led to more risk aversion among Emerging Markets investors after the financial crisis.

Exhibit 62: Fundamentals across regional markets

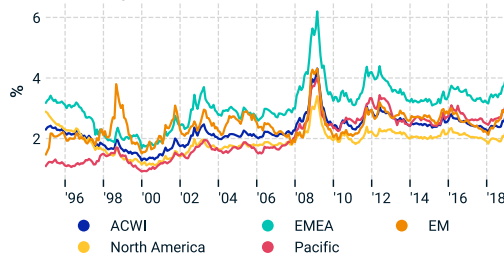
Price to book value



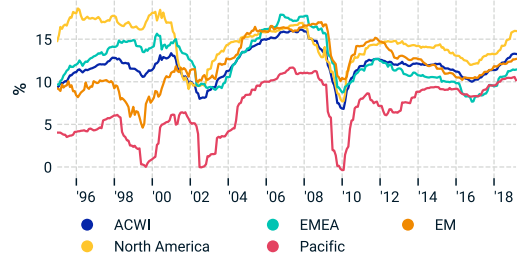
Price to earnings*



Dividend yield



Return on equity



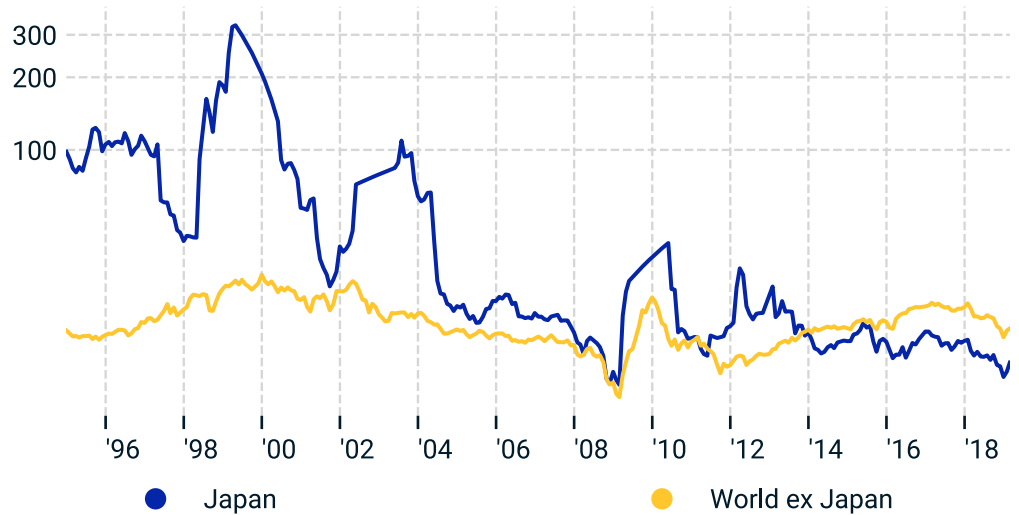
Source: MSCI. Data from Dec. 30, 1994 to Feb. 28, 2019.

*Top and bottom 10% outliers in Pacific are dropped using linear interpolation method.

In the above analysis, Pacific stands out as the region that showed a large decline in P/E ratios and the lowest level of profitability over the study period. This was caused by the Japanese stock market, providing an example of how a regional stock market can turn from a bubble into a long-lasting fundamental decline. Exhibit 63 illustrates this decline by comparing Japan's P/E ratio to MSCI World ex Japan over the study period. Japan's equity market peaked at P/E ratios above 300 at the height of the dotcom bubble but declined substantially thereafter, with periods when earnings turned negative in the aftermath of both the dotcom bubble and the financial crisis.

While the P/E ratio of MSCI World ex Japan also showed strong cyclical behavior, the overall P/E ratio remained positive between 10 and 30 throughout the study period.

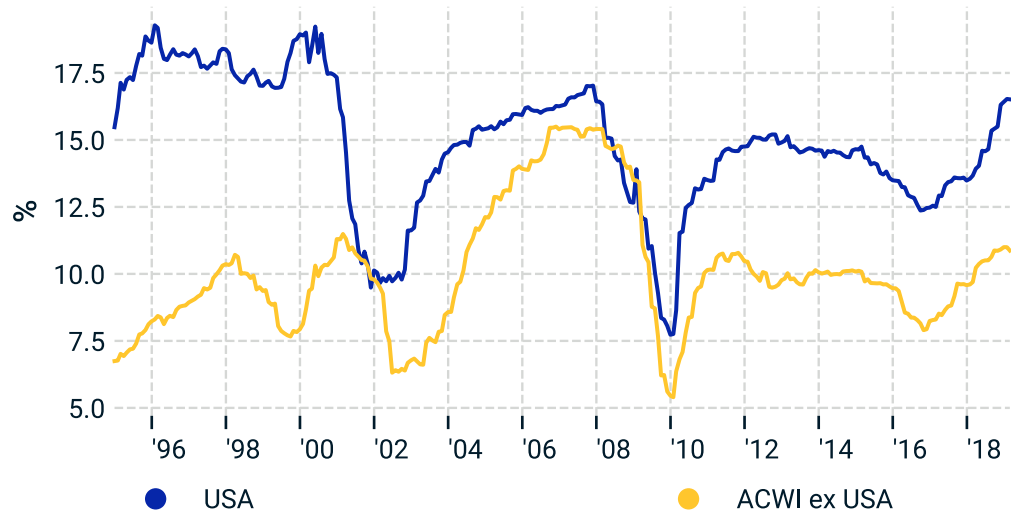
Exhibit 63: P/E ratio of Japan versus MSCI World ex Japan



Source: MSCI. Data from Dec. 30, 1994 to Feb. 28, 2019.

On the other hand, North America saw the strongest growth in valuation levels together with strong growth in return-on-equity over the past decade, due to the effect of the U.S. stock market. Exhibit 64 compares the U.S. equity market (MSCI USA) to MSCI World ex USA in terms of historical RoE ratios. Except for the financial crisis in 2008, the U.S. stock market was far more profitable than other global stock markets throughout the study period. The largest difference in profitability was during the economic boom of the 1990s. Profitability ratios in the U.S. also rebounded faster after the dotcom bubble and after the financial crisis than in the rest of the world. Moreover, since 2016 the profitability advantage of the U.S. has increased.

Exhibit 64: RoE of US versus MSCI ACWI ex US

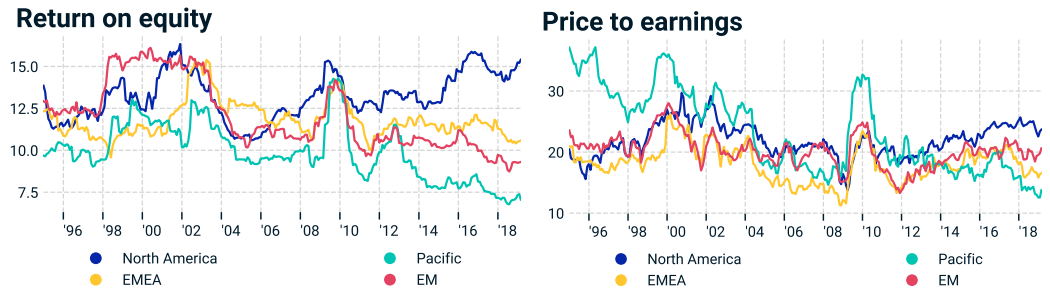


Source: MSCI. Data from Sep. 29, 1995 to Feb. 28, 2019.

Overall, the rally of the U.S. stock market observed during the study period was associated with higher corporate profitability in North America than in other regions.

When looking at profitability and valuation levels, it is also important to understand the level of dispersion of these financial metrics across the four regions. Exhibit 65 looks at the cross-sectional standard deviation of individual stock returns in each region. Two observations are worth noting: Firstly, the dispersion in both profitability and valuation has been quite cyclical, with higher dispersion during times of financial distress and lower dispersion in calm markets. Secondly, dispersion in profitability and valuation levels increased noticeably in North America during the last decade to exceed levels in other regions. Thus, the growth in profitability and valuation in North America seen in Exhibit 62 was unevenly distributed across the region’s equity markets.

Exhibit 65: Cross-sectional standard deviation of RoE (left) and P/E ratios (right)

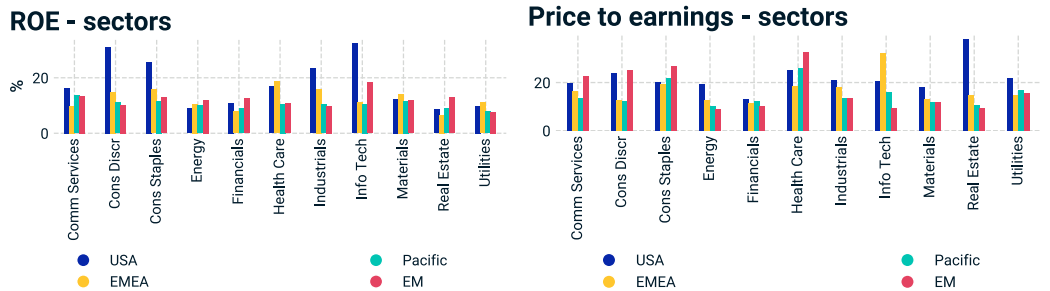


Source: MSCI. Data from Dec. 30, 1994 to Feb. 28, 2019.

Exhibit 66 takes a closer look at this increase in dispersion in North America by showing valuation and profitability ratios per sector. Both the higher profitability levels and the higher level of dispersion in profitability in North America were explained to some extent by sectoral differences: Thus, the U.S. Information Technology, Consumer Discretionary and Consumer Staples sectors saw significantly higher profitability (RoE) ratios than other sectors in North America and the same sectors in other regions. The higher profitability seen during the past decade in North America was thus not a broad market effect but was just limited to a few sectors.

However, the higher level of profitability in these North American sectors did not lead to extreme valuation levels: In fact, valuation levels in these sectors are now in line with other regions. Therefore, the increasing level of dispersion in valuation levels seen in North America (Exhibit 65) was not just due to sectoral effects.

Exhibit 66: RoE (left) and P/E (right) across sectors and four regions



Source: MSCI. Data as of Feb. 28, 2019. MSCI USA sector indexes used as a proxy for North America.

Investors may wish to consider the dispersion in North American equity markets going forward, since increasing dispersion in profitability and valuation may make them more vulnerable to shocks.

Fundamental return decomposition

Long-term investors also typically seek to understand the long-term drivers of equity returns. While standard equity factor models can be used to assess systematic return drivers of active portfolios versus the market benchmark, the purpose of the following analysis is to understand the underlying return drivers that may explain return differences in regional market benchmarks. Therefore, we use fundamental models to decompose equity returns into fundamental drivers, as proposed in Straehl and Ibbotson (2016): the book-on-equity approach and the dividends growth model. We focus on the book-on-equity model in the main section of this report. Results for the dividend growth model can be found in the Appendix.

As a first step, the book-on-equity model decomposes long-term total equity returns into dividends received and the price return of stocks. The second step is to decompose the price return of equities into its fundamental drivers. In simple terms, there are three fundamental drivers that can explain price movements in equities (see Appendix):

1. A change in the price-to-earnings ratio (P/E), i.e., a change in the multiple at which the market is pricing a given level of earnings.
2. A change in corporate profitability as measured by return-on-equity (RoE).
3. A change in corporates' book value of equity.

The aggregate of the change in RoE and the change in book value is equivalent to the change in corporates' earnings. Therefore, another way of describing the book-on-equity model is that it decomposes equity price movements into changes in earnings and changes in earnings multiples.

In the following, we will apply the book-on-equity model in two steps: First, we look at the decomposition of equity returns into earnings growth and changes in P/E ratios. In the second step we then apply the full book-on-equity model by decomposing earnings growth into changes in RoE ratios and changes in book value over different time horizons.

Analysis of earnings growth

The breakdown of regional equity returns into real earnings growth plus inflation (using USA CPI inflation levels), changes in P/E ratios and dividend yield is shown in

Exhibit 67 and Exhibit 68. We observe that, particularly over longer periods of time, earnings growth was the strongest contributor in explaining total equity returns, while changes in P/E ratios showed a strong contribution to equity returns over a 10-year period, but contributed less over the full period. Pacific stands out as the only region showing a long term decline in P/E ratios, which was due to the afore-mentioned fundamental decline in the Japanese stock market (Exhibit 63). EMEA showed the lowest level of earnings growth of all regions.

Exhibit 67: Book-on-equity breakdown using earnings growth (10y period)

Region	Total return	Inflation	PE growth	Earnings growth	Dividend yield
ACWI	11.73	1.78	5.1	1.94	2.68
North America	14.5	1.78	4.79	5.25	2.18
EMEA	8.41	1.78	6.68	-3.56	3.68
Pacific	8.4	1.78	1.63	2.03	2.85
EM	9.56	1.78	4.32	0.71	2.73

Source: MSCI, OECD. Data from Dec. 31, 2008 to Feb. 28, 2019. Inflation data is based on USA inflation (CPI) levels.

Exhibit 68: Book-on-equity breakdown using earnings growth (full period)

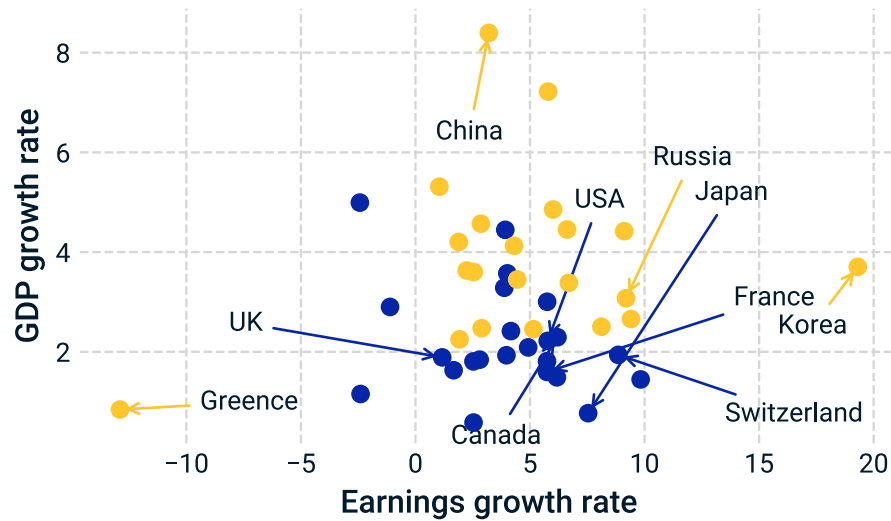
Region	Total return	Inflation	PE growth	Earnings growth	Dividend yield
ACWI	6.37	2.18	-0.89	2.74	2.32
North America	7.65	2.18	0.31	3.21	1.92
EMEA	6.08	2.18	-0.27	1.06	3.14
Pacific	3.4	2.18	-5.23	4.56	2.15
EM	6.87	2.18	-0.92	3.02	2.56

Source: MSCI, OECD. Data from Dec. 30, 1994 to Feb. 28, 2019. Inflation data is based on USA inflation (CPI) levels. Total returns shown are averages of rolling 20-year returns.

At a global level, earnings growth was clearly the strongest contributor to equity returns for the full study period. For investors in global equity markets, an important question is how far earnings growth may be driven or supported by countries' GDP growth. The comparison of earnings growth to GDP growth across countries during

the study period shows fairly little correlation between economic growth and earnings (Exhibit 69).

Exhibit 69: Earnings growth versus GDP growth



Source: MSCI. Data from Dec. 31, 1997 to Feb. 28, 2019.

Fundamental return drivers over different time horizons

The second step in our analysis is to decompose earnings growth into changes in RoE and changes in book value. The financial model used for this analysis is detailed in the Appendix. The change in book value is decomposed into the real change and an inflation component, using USA CPI inflation levels, since all return calculations are based in USD. Starting with the global analysis (MSCI ACWI) shown in Exhibit 70 and Exhibit 71, we observe that over longer periods of time, changes in book value (real book value change plus inflation) showed the strongest contribution to equity returns.

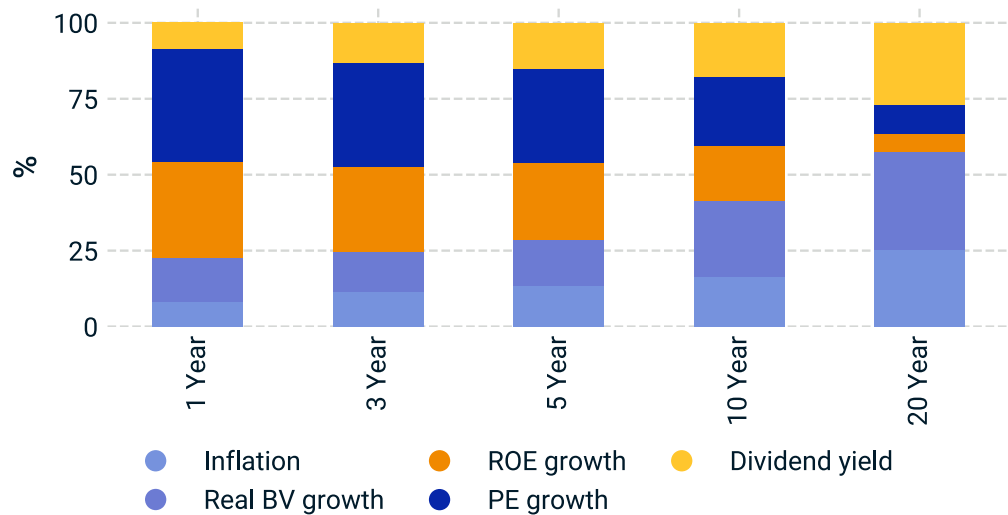
Exhibit 70: Book-on-equity decomposition of equity returns

Region	Total return	Inflation	Real BV growth	ROE growth	PE growth	Dividend yield
ACWI	6.37	2.18	2.8	-0.05	-0.89	2.32
North America	7.65	2.18	4.42	-1.21	0.31	1.92
EMEA	6.08	2.18	2.55	-1.48	-0.27	3.14
Pacific	3.4	2.18	0.48	4.08	-5.23	2.15
EM	6.87	2.18	1.83	1.19	-0.92	2.56

Source: MSCI, OECD. Data from Dec. 30, 1994 to Feb. 28, 2019. Inflation data is based on USA inflation (CPI) levels. Total returns shown are averages of rolling 20-year returns.

This finding is in line with the economic intuition that both RoE and P/E ratios cannot rise or fall indefinitely and therefore their return contribution can be expected to be smaller than the change in book value in the long run. For instance, Becket et al. (2012) found P/E ratios to be mean reverting in the long run in the U.S. market. The return contribution from changes in both RoE and P/E has decreased over time (Exhibit 71), in line with economic intuition. We also observe that over a third of the growth in book value has been explained by inflation.

Exhibit 71: Book-on-equity return breakdown for MSCI ACWI

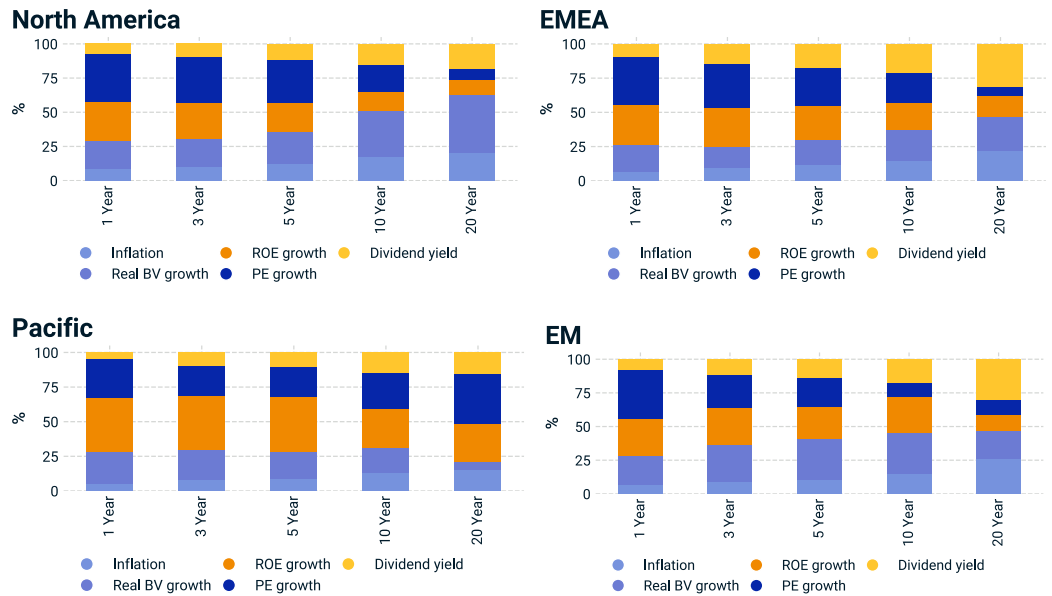


Source: MSCI, OECD. Data from Dec. 30, 1994 to Feb. 28, 2019. Inflation data is based on USA inflation (CPI) levels.

Next, we look at regional differences in the book-on-equity decomposition of equity returns (Exhibit 72). The return breakdowns for North America, Emerging Markets and EMEA look very similar to the global breakdown, but with a lower level of book value growth in EMEA and Emerging Markets.

The most noticeable difference is for the Pacific region, where even over 20 years changes in valuation levels and profitability were the main contributors to equity returns, whereas changes in book value were relatively small. This was caused by the afore-mentioned steady decline of P/E ratios in the Pacific region (Exhibit 62), mainly due to Japanese stock market movements.

Exhibit 72: Regional book-on-equity return breakdown



Source: MSCI, OECD. Data from Dec. 30, 1994 to Feb. 28, 2019. Inflation data is based on USA inflation (CPI) data.

In brief, our analysis using the book-on equity model shows that, during the full study period, earnings growth was the strongest contributor to stock returns. When decomposing earnings growth, the change in book value was the strongest contributor.

Economic exposure to Emerging Markets as return driver

In section one we looked at the development of regional economic exposures. From a global investor’s perspective, the important question is the extent to which global

revenue exposures drive stock market returns. For instance, our analysis in section one showed that economic growth was stronger and is forecast to remain stronger in Emerging Markets than in Developed Markets, which may drive the stock returns of companies that derive revenues from this region.

Exhibit 73 puts this theory to the test by examining the performance of regional benchmarks with economic exposure to Emerging Markets and regional benchmarks with economic exposure to their own region, relative to their market benchmark. These economic exposure benchmarks are calculated in line with the official MSCI Economic Exposure Indexes methodology, which selects the top 25% companies in terms of economic exposure to the respective region from the benchmark universe under additional diversification constraints.²⁴

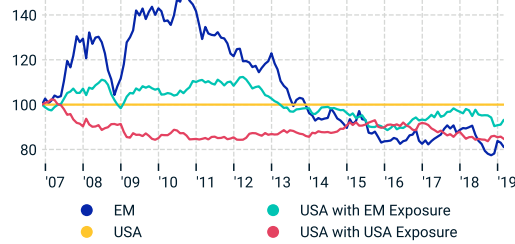
During the last decade, in Europe and the Pacific region, companies with economic exposure to Emerging Markets outperformed their regional benchmark. The benchmark with economic exposure to their own region underperformed the local benchmark in Europe and performed in line with benchmark in the Pacific region. In the U.S., however, companies with economic exposure to EM slightly underperformed the local benchmark and showed a similar performance as companies with strong economic exposure to the home market.

At an MSCI World level, the performance of companies with EM exposure and domestic exposure was relatively similar. This was because MSCI World contains the U.S. market, where companies with EM exposure slightly underperformed their benchmark, and Europe, where companies with EM exposure outperformed. In addition, we observed that the performance of companies in MSCI World with high EM exposure was less volatile than MSCI Emerging Markets.

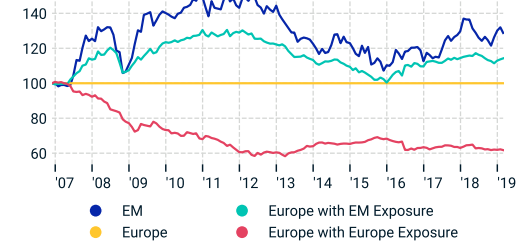
²⁴https://www.msci.com/eqb/methodology/meth_docs/MSCI_Economic_Exposure_Indexes_Methodology_June2017.pdf

Exhibit 73: Regional performance and economic exposure to Emerging Markets

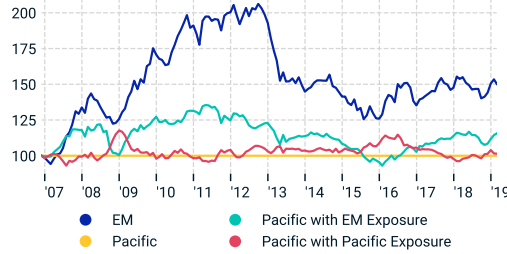
Relative performance to USA



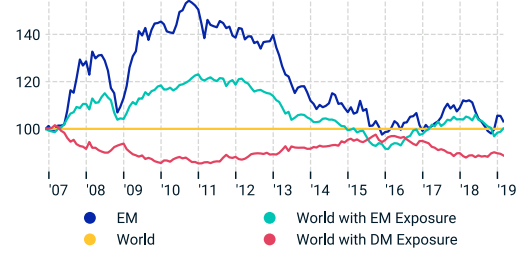
Relative performance to Europe



Relative performance to Pacific



Relative performance to World



Source: MSCI. Data from Nov. 30, 2006 to Feb. 28, 2019.

USA with USA Exposure, Pacific with Pacific Exposure and Pacific with EM Exposure are simulated indexes.

Performance calculated using local currency levels.

In addition, Exhibit 74 shows the absolute risk and performance figures of the simulated economic exposure benchmarks.

Exhibit 74: Absolute risk and performance of economic exposure benchmarks

Metrics	World with EM Exposure	World with DM Exposure	USA with EM Exposure	USA with USA Exposure	EM
Total return (%)	6.02	4.98	7.47	6.66	6.28
Sharpe ratio	0.36	0.35	0.42	0.42	0.36
Volatility PA	15.55	13.01	16.67	14.71	16.44
VaR @ 99%	-12.76	-9.7	-11.07	-12.19	-12.39
CVaR @ 99%	-16.8	-12.87	-15.93	-14.81	-17.35
Max drawdown (%)	-50.06	-53.91	-51.51	-56.81	-51.67

Metrics	Europe with EM Exposure	Europe with Europe Exposure	Pacific with EM Exposure	Pacific with Pacific Exposure	EM
Total return (%)	5.25	0.09	1.19	0.12	6.28
Sharpe ratio	0.31	-0.02	0.09	-0.05	0.36
Volatility PA	15.64	17.16	8.16	6.61	16.44
VaR @ 99%	-13.69	-13.02	-5.36	-4.34	-12.39
CVaR @ 99%	-16.92	-15.47	-7.85	-4.41	-17.35
Max drawdown (%)	-49.12	-63.1	-31.32	-18.61	-51.67

Source: MSCI. Data from Nov. 30, 2006 to Feb. 28, 2019.
 Metrics are calculated using local currency values.

A key question for the future is how far China, as part of Emerging Markets, will continue to follow the so-called East Asian Growth model²⁵ of Japan, Taiwan and Korea. In the first stage of development, this model relies heavily on export-led growth and a very high domestic savings rate to foster infrastructure investment and corporate development, and at a later stage allows for more domestically driven growth by supporting domestic consumption.

China’s growth and savings rate in its first stage of development were even higher than in Japan or Korea at the same stage.²⁶ The question now is how far the shift to more dependence on domestic demand in China will go and which companies or industries stand to gain. Assessing the economic exposure of industries, as shown in Exhibit 17, may give some pointers.

Summary of key observations

- In the last decade, stock market growth showed strong regional differences, with North America outperforming all other regions. This disparity was also reflected in the underlying fundamental drivers: While North America was the most profitable region as measured by the region’s index RoE, it also saw the strongest valuation expansion in terms of price-to-book and price-to-earnings ratios. This contrasted with the Pacific region, where valuation levels fell, mainly due to sluggish equity market returns in Japan.

²⁵ Baltho and Weber (2009).

²⁶ Baltho and Weber (2009).

- Applying the book-on-equity model showed that earnings growth was the strongest contributor to global stock returns during the study period. Decomposing earnings growth, the change in book value was the strongest contributor.
- Our analysis has shown very little correlation between GDP growth on the one hand and earnings growth and stock market growth on the other hand.
- North America also saw an increasing level of cross-sectional dispersion in profitability and valuation levels, with the Information Technology sector showing the highest level of profitability.
- Country equity risk premia were higher in Emerging Markets than in Developed Markets, but at the same time showed greater dispersion across countries. Country risk premia were driven by the level of sophistication of the market (smaller and less liquid markets showed a premium) as well as by the level of country governance risk (higher country risk showing an additional premium).
- Emerging Markets' economic relevance as measured by GDP or as their share of global sales revenues ("economic exposure") grew faster than their weight in MSCI ACWI, reflecting their increasing economic relevance. In Europe and the Pacific regions, companies with high revenue exposure to Emerging Markets outperformed their peers, in contrast to North America, where companies with economic exposure to EM slightly underperformed the local benchmark.

4. Performance stress tests

Performance stress testing can be an important part of financial risk management, assessing risks that go beyond standard risk measures such as volatility or Value-at-Risk and relating them to extreme market conditions. In the following, we will look at two types of performance stress tests for global regions: first, historical stress tests, based on historical worst case movements in market prices for stocks and second, fundamental stress tests, based on historical worst case movements in market fundamentals. We perform stress tests at a global and regional level. Stress testing at a regional level is important to assess the potential impact of regional concentration risks.

Historical stress tests

Exhibit 75 shows the financial impact of historical and hypothetical stress scenarios on global and regional benchmarks as of Feb. 28, 2019. It is interesting to note how susceptible to shocks all regions – especially Emerging Markets – appear through the lens of historical stress testing, even if the shock occurred in another region. For instance, the euro crisis scenario led to significant drawdowns in Emerging Markets and the Pacific region. The Asian crisis led to shocks in all global equity markets. This confirms the finding in section two that global equity markets are highly correlated, especially in times of financial distress. On average, crisis-related drawdowns were slightly lower in North America than in other regions, which mirrored North America’s lower level of economic interaction with other regions noted in section one of this report.

Exhibit 75: Historical stress test overview

Crisis Event	ACWI	North America	Europe	Pacific	EM
Asian Crisis (1997)	-10.51%	-8.95%	-10.28%	-10.59%	-18.56%
Gulf War (1990)	-6.33	-5.60	-6.18	-9.08	-7.59
Mexican Crisis (1995)	-0.51	1.09	-1.48	-5.08	-2.41
Russian Devaluation (1998)	-8.20	-9.38	-7.16	-3.06	-8.95
Black Week 5D (2008)	-17.13	-17.05	-18.97	-14.26	-17.24
Fall 2008 (2008)	-28.37	-31.97	-22.16	-30.16	-19.02
Euro Stress Scenario Analysis	-7.26	1.41	-15.36	-27.28	-17.76

The periods are defined as follows:

- (1) Asian Crisis: October 14, 1997 – October 27, 1997
- (2) Gulf War: July 24, 1990 - August 6, 1990
- (3) Mexican Crisis: January 10, 1995 – January 23, 1995
- (4) Russian Devaluation: August 21, 1998 – September 3, 1998
- (5) Black Week: October 6, 2008 – October 10, 2008

(6) *Fall 2008: September 9, 2008 – December 1, 2008.*

(7) *Euro Stress Scenario Analysis: Hypothetical stress test covering extreme crisis events in Europe such as Brexit, etc.*

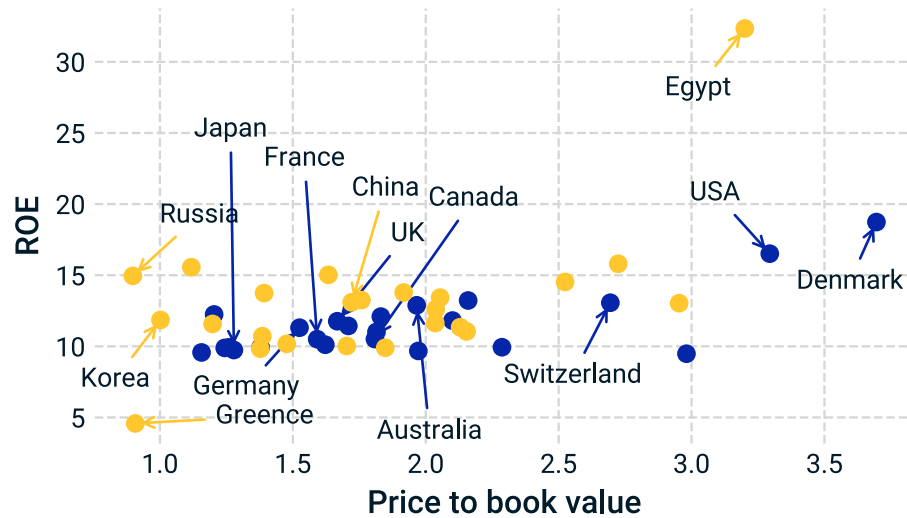
Source: MSCI.

Fundamental stress tests

Decomposing equity returns based on the book-on-equity model (see section three) is also useful for performing fundamental stress tests. While the historical stress tests presented in Exhibit 75 are linked to historical events and therefore are typically based on a relatively short time period, fundamental stress tests can be used to assess hypothetical scenarios that may occur over longer periods. For instance, we can simulate a long-term fundamental downturn in North America that follows a similar fundamental trajectory as Japan over the past 20 years.

When designing fundamental stress tests, it is important to understand that different markets can be in very different fundamental states: These form the basis for a stress test. For instance, when we look at the dispersion in fundamental profitability and valuation levels across countries within MSCI ACWI (Exhibit 76), we observe that there has been a clear correlation between countries' profitability (RoE) and valuation as measured by the price-to-book ratio, in line with the economic intuition that profitable companies (on average) show higher levels of valuation. Within Developed Markets, the USA clearly stands out compared to European equity markets (U.K., Germany, France) and Japan, with a much higher price-to-book ratio but also higher profitability.

Exhibit 76: Return-on-equity vs price-to-book ratios of countries in MSCI ACWI



Source: MSCI. Data as of Feb. 28, 2019.

In addition, Exhibit 77 looks at the return-on equity versus book value profile of the four regions. It is interesting to note that North America clearly showed the highest profitability as well as the highest level of valuation compared to the other regions, whereas the Pacific region had the lowest profitability and the lowest valuation. Emerging Markets and EMEA were in the middle range on both measures, with slightly higher profitability and slightly lower valuation levels in Emerging Markets compared to EMEA.

Exhibit 77: Return-on-equity vs price-to-book ratios of regions



Source: MSCI. Data as of Feb. 28, 2019.

In addition, we observe that Emerging Markets showed a much higher level of country dispersion, especially in terms of return-on-equity, with Greece showing the lowest and Egypt the highest level of profitability.

We note that markets’ valuation levels had a strong influence on expected returns in the long run. To investigate this phenomenon, we regressed realized 10-year equity returns for each region over their book-to-price ratio at the beginning of the period. The regression lines in Exhibit 78 reveal a clear negative correlation between markets’ valuation level and the subsequent 10-year total return, with higher valuation levels typically resulting in lower returns. Exhibit 78 also highlights the historical range of valuation levels observed in each region (as a gray zone) and the current level of valuations, which for all regions was closer to the historical minimum than to the maximum. The returns indicated in red are the worst-case returns that this regression model would forecast for a 10-year period, when the respective market is at the highest historical valuation level at the beginning of that period.

We also observe that markets priced at the higher end of valuation levels were associated with negative average realized subsequent returns – and a corresponding drop in fundamental valuation levels. Furthermore, during the study period North America saw the largest cyclicity in price-to-book ratios (ranging from about 1.5 to 5.5), in contrast to the Pacific region where the variation was lowest. This confirms the afore-mentioned finding that North American equity markets were the most cyclical of the four regions in terms of market fundamentals. In addition, it also shows that markets can undergo a fundamental long-term shift in valuations.

Exhibit 78: Historical 10-year returns versus initial book-to-price level



Source: MSCI. Data from Dec. 30, 1994 to Feb. 28, 2019.

To simulate such a fundamentally driven drop in valuation, we use a simplified version of the book-on-equity model: we consider fundamental changes in the price-to-book value of markets (the aggregate of changes in P/E ratio and changes in RoE) and changes in the book value of companies. For each region we consider a fundamental stress scenario in three variables:

1. Price-to-book ratio: We simulate a fall in price-to-book (PB) ratios to each region’s historical minimum from the price-to-book ratio as of 28 February 2019.
2. Book value: We apply a fall in companies’ book value in line with the largest historical fall observed in the region.
3. Dividend yield: The dividend yield in each region falls to its historical minimum.

For each scenario, we simulate the expected return of each of these three input parameters by region, as shown in Exhibit 79. In addition, we indicate the worst-case loss where all three stress parameters are applied in parallel.

Exhibit 79: Fundamental stress tests: regional scenarios (absolute fall in PB)

Stress test	ACWI	North America	EMEA	Pacific	EM
Book Value	-15.50	-12.77	-23.06	-35.33	-38.36
Price to Book Value	-44.30	-53.87	-25.45	-29.86	-42.85
Yield	1.27	1.11	1.68	0.91	1.47
Historical min	-58.53	-65.53	-46.83	-64.27	-79.73

Source: MSCI. Data from Dec. 30, 1994 to Feb. 28, 2019.

Notably, the potential financial losses in these scenarios exceed losses in historical stress tests. This analysis shows the potential importance of regional diversification for averaging out differences in the long-term trajectories of various markets.

In addition, we have run similar fundamental stress tests, but instead of using the absolute historical minimum of PB ratios we apply the largest historical relative drop in price-to-book ratios in each region. On this assumption, PB ratios may potentially fall below their historical minimum and therefore may produce even more severe loss scenarios, as shown in Exhibit 80: Except for EMEA, all regions showed more severe losses than in Exhibit 79.

Exhibit 80: Fundamental stress tests: regional scenarios (relative drop in PB)

Stress test	ACWI	North America	EMEA	Pacific	EM
Book Value	-15.50	-12.77	-23.06	-35.33	-38.36
Price to Book Value	-69.11	-73.83	-23.95	-60.17	-56.45
Yield	1.27	1.11	1.68	0.91	1.47
Historical min	-58.53	-65.53	-46.83	-64.27	-79.73

Source: MSCI. Data from Dec. 30, 1994 to Feb. 28, 2019.

Summary of key observations

- Historical stress tests show how inter-connected regional equity markets are in times of financial distress.
- Fundamental stress tests go beyond applying relatively short-term equity price shocks to a portfolio and are useful to simulate a potential long-term decline in a market, as for example seen in Japan in the past three decades. The simulated results show potentially more drastic drawdown scenarios than historical stress tests, which could occur over long periods of time.

5. Simulation of global index weighting schemes

In sections two, three and four we have assessed the historical diversification and performance characteristics of global and regional markets. In this section, we simulate different alternative regional weighting schemes to assess how far these simulations may show potential improvements in performance, risk and diversification characteristics. We apply the same analysis methodologies for risk, diversification, performance and fundamental drivers as in sections two, three and four of this report. We also assess how far these alternative weighting schemes change the representativeness of the global opportunity set and the liquidity profile of the index.

Assessment of different weighting schemes

This section focuses on the simulation of potential global indexes, using different versions of regional weighting schemes for the four main regions: North America, EMEA, Pacific and Emerging Markets.

While free-float market capitalization weights are the natural starting point for building benchmarks, as they represent the liquid opportunity set in equity markets at any given point in time, there are economic reasons for long-term asset owners to assess different weighting schemes: When using market-cap weights, investors will be exposed to countries that have high valuation levels in equity markets. While high valuation levels may be due to high levels of profitability, investors may face the risk of being exposed to temporary bubbles in stock prices, which will have a large weight in the benchmark and therefore expose investors to risks when the bubble bursts. The Japanese stock market bubble build-up during the 1980s is one example of this type of regional concentration risk in market-cap benchmarks.

In the following, we explore ways to create indexes that can be replicated in a cost-efficient way, which offer potential improvements in diversification and a reduction in concentration risks, and can capture equity risk premia across markets.

Consequently, it may be important to understand how far alternative weighting schemes could offer better diversification benefits and potentially reflect a more forward-looking way of allocating capital in global equity markets.

Criteria that long-term investors may consider when comparing differences in regional weightings schemes include:

1. Benchmark representativeness: Overall, any benchmark under consideration should still fulfill the basic criteria for a global benchmark described in more

detail in section eight of this report: representativeness, efficiency and replicability.

2. Financial performance: since past performance is not an indicator of future results, a performance comparison would likely focus on understanding the fundamental drivers that explain performance differences and an assessment of how far different weighting schemes offer exposure to regions with economic growth.
3. Risk: For long-term investors, the assessment of risks may need to go beyond measures of short-term market risks (volatility, VaR) to include regional and industry concentration risks as well as an analysis of market fundamentals.
4. Diversification: long-term investors may look at the short-term diversification of market risks as well as the long-term diversification of different regional growth trajectories.

Regional weighting schemes and their economic rationale

The purpose of the following analysis is to assess differences in risk, performance and diversification across different variants of regional weighting schemes. The base universe for these simulated benchmarks is the MSCI ACWI Index.

The following analysis is based on either existing or simulated methodologies, i.e.,

1. Weighting securities according to their free-float adjusted market capitalization (i.e., the existing **MSCI ACWI** Index).
2. Weighting regions according to GPF's current regional weighting scheme²⁷ (the simulated **ACWI IMI Customized**). This simulation is a proxy for GPF's current benchmark and is the only benchmark simulation that contains small caps.
3. Weighting securities according to their total market capitalization (the existing **ACWI Total Mcap**).
4. Using the existing MSCI World total market-cap benchmark (**World Total MCap**) to compare returns to a benchmark that only includes investments in Developed Markets.

²⁷ In section eight of this report, we compare GPF's current benchmark with MSCI GIMI methodology in detail.

5. Weighting the four regions according to their GDP on a yearly basis (the simulated **ACWI GDP**). We will use absolute values of GDP in USD without adjusting for purchasing power.
6. Equal-weighting the four regions (the simulated **ACWI EW**).
7. Using the concept of regional risk weighting (the simulated **ACWI RW**): the weight of each region is inversely related to the risk of its regional benchmark. We use the variance of past 5y monthly returns as a risk measure to ensure the weighting scheme is based on longer-term risk considerations.

In brief, in our analysis we compare alternative weighting schemes (weighting by GDP, risk weighting and equal weighting) to four versions of cap-weighted benchmarks (MSCI ACWI, MSCI ACWI Total Mcap, MSCI World Total Mcap and GPF's current regional weighting scheme, ACWI IMI customized).

To minimize the risk of creating benchmarks that no longer represent the opportunity set or are no longer replicable in an efficient way, we have used four regional free-float-adjusted market capitalization benchmarks as a starting point and only re-weighted regions using one of the above-mentioned methods. The only exception are the total market-cap weighted benchmarks, which are based on the total market capitalization of each security.

Before looking at the simulated results, it is important to understand the economic rationale for each of these methodologies.

To start with, total market capitalization weights represent the allocation of the average investor in the market. As we have seen in section one of this report, equity markets' total market capitalization is highly correlated to the free-float market capitalization. However, total market-cap weights attribute more benchmark weight to Emerging Markets, where average free-floats are lower. This may represent a more forward-looking view of investment opportunities in countries with strong economic growth: Economic growth often goes hand-in-hand with increasing market liberalization of ownership structures, which may herald increasing free-floats. At the same time, total market-cap weights were lower in North America, the most liquid equity market, which currently accounts for almost 60% of global free-float market capitalization in equities. Total market-cap weights may therefore offer additional diversification benefits due to a more uniform regional allocation of assets.

Weighting regions based on GDP presents several advantages. First, GDP weights represent the actual economic size of each region and are independent of historical stock performance, clearly reducing the risk of overexposure to regional bubbles in stock prices and therefore providing less cyclical equity exposure. Second, they offer

better regional diversification and more exposure to regions with strong economic growth, i.e., Emerging Markets.

By contrast, risk weighting and equal weighting take a very pragmatic approach. The economic trajectories and future stock prices for global regions are unpredictable and therefore simply equal-weighting these four regions serves the purpose of diversifying regional risks. Ultimately, investors face the risk that either the strong economic and stock market growth in North America and/or the growth in Emerging Markets may come to an end or even reverse. Equal-weighting is an effective way to deal with this risk, as it does not rely on any financial or economic indicator derived from the past. In addition, in the Appendix we show that given the relatively uniform covariance matrix of regions (Exhibit 31), equal weighting is a good proxy for the concept of equal risk contribution, where the weighting scheme ensures that each region has the same marginal contribution to portfolio variance. By contrast, the risk weighting approach used in the following comparison is slightly more nuanced, as regions that have been more volatile during the past five years are slightly underweight compared to regions that have been less volatile.

We now assess the different variants of global benchmarks based on the four previously mentioned criteria: Benchmark representativeness and replicability, performance, risk and diversification. We use a simulation horizon from December 1994 to February 2019 for all approaches.

Representativeness of benchmarks

Following the detailed description of the MSCI Global Investable Market Index (“GIMI”) methodology shown in section eight hereafter, a meaningful benchmark for long-term investors should represent the underlying equity opportunity set in an efficient and replicable way.

Regional and sectoral allocation

Due to their construction, these different benchmark variants had very different regional weights (Exhibit 81). The differences in regional weights attributed to EMEA and Pacific were relatively small across the approaches, the main difference being in their allocation to North America versus Emerging Markets. In essence, the choice between free-float weights and alternative weights was historically mainly a choice of attributing weight to North America versus Emerging Markets. By construction, MSCI World total market-cap weighting showed the highest attribution of weights toward North America, as it does not contain Emerging Markets exposure. ACWI total market-cap weights attributed slightly more weight to EM and less to North America than MSCI ACWI, and were followed in decreasing order of weight attributed

to North America by ACWI IMI customized, regional risk weighting (RW), GDP and finally equal weights (EW). As outlined in section one, the reason for the large difference in the allocation to North America versus Emerging Markets was the large discrepancy between Emerging Markets GDP and its free-float adjusted market capitalization, as well as the lower relative valuation levels in Emerging Markets.

Exhibit 81: Regional weights of simulated benchmarks (%)²⁸

Region	ACWI	ACWI IMI Customized	ACWI Total Mcap	World Total Mcap	ACWI GDP	ACWI EW	ACWI RW	ACWI EW
North America	57.95	41.24	46.57	60.81	28.17	24.54	34.88	24.54
EMEA	19.25	34.11	18.41	24.04	23.23	25.12	22.87	25.12
Pacific	11.14	12.41	11.6	15.15	9.69	24.79	26.3	24.79
EM	11.66	12.24	23.41	0.0	38.92	25.55	15.96	25.55

Source: MSCI. Data as of Feb. 28, 2019.

The comparison of country weights (Exhibit 82) confirms the finding that total market capitalization weights were close to the MSCI ACWI Index, whereas equal weighting and risk weighting generally led to the strongest shifts in country weights. For instance, using equal weights led to less than half the U.S. exposure and more than double the exposure in Japan compared to MSCI ACWI.

Exhibit 82: Ten largest country weights in simulated benchmarks

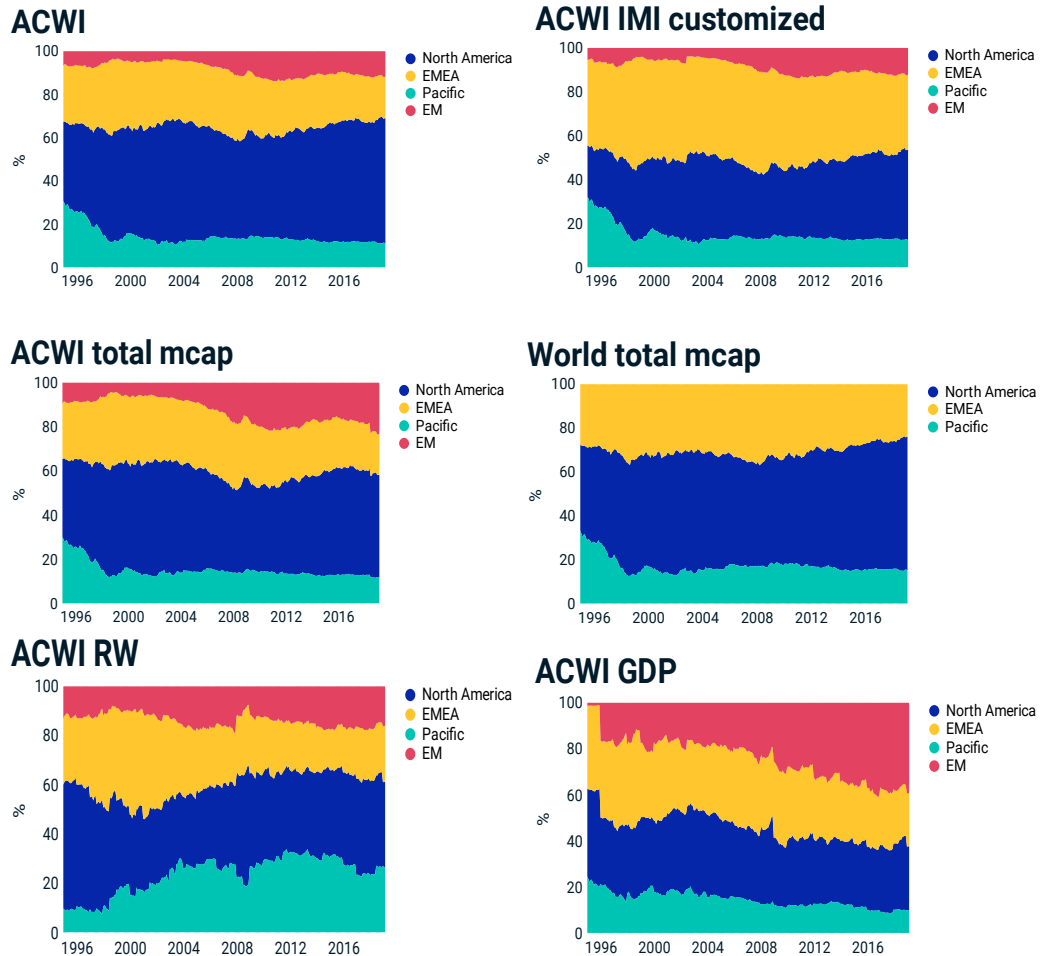
Country	ACWI	ACWI IMI Customized	ACWI Total Mcap	World Total Mcap	ACWI GDP	ACWI EW	ACWI RW	ACWI EW
USA	54.85	39.01	43.89	57.3	26.66	23.23	33.01	23.23
Japan	7.32	8.26	7.58	9.9	6.35	16.25	17.24	16.25
UK	5.18	9.58	4.16	5.43	6.25	6.76	6.15	6.76
China	3.75	3.66	11.74	0.0	12.51	8.21	5.13	8.21
France	3.41	5.58	3.75	4.89	4.11	4.45	4.05	4.45
Canada	3.1	2.24	2.68	3.5	1.51	1.31	1.86	1.31
Switzerland	2.67	4.49	2.26	2.95	3.22	3.48	3.17	3.48
Germany	2.66	4.6	2.65	3.46	3.21	3.47	3.16	3.47
Australia	2.11	2.33	1.74	2.27	1.84	4.72	5.0	4.72
Korea	1.6	1.74	1.88	0.0	5.33	3.5	2.19	3.5

Source: MSCI. Data as of Feb. 28, 2019.

²⁸ The names of the different weighting schemes and benchmarks are defined in the introduction to this section.

The evolution of regional weights shown in Exhibit 83 indicates that MSCI World total-cap weighting and free-float weighting saw the most extreme shifts toward North America over time, whereas GDP weighing saw the most extreme shift toward Emerging Markets, due to their higher economic growth rates. The equal weighting approach stands out with (by construction) fairly constant regional weights.

Exhibit 83: Regional weights of simulated benchmark schemes



ACWI EW



Source: MSCI. Data from Dec. 30, 1994 to Feb. 28, 2019.

While all of the alternative weighting schemes created less regionally concentrated portfolios than MSCI ACWI (except MSCI World total market cap weighting), we must also consider the sector representation and replicability of these alternative benchmarks.

Sector composition

We show the sectoral composition of the benchmarks in Exhibit 84 and their evolving historical weight in Exhibit 85. Overall, we observe that all benchmark variants represented the sectors and their development over time in a similar way to the free-float market capitalization benchmark.

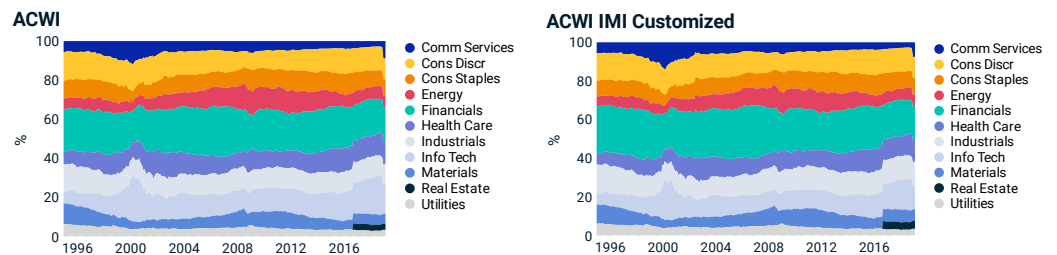
Exhibit 84: GICS sector representation of simulated benchmarks

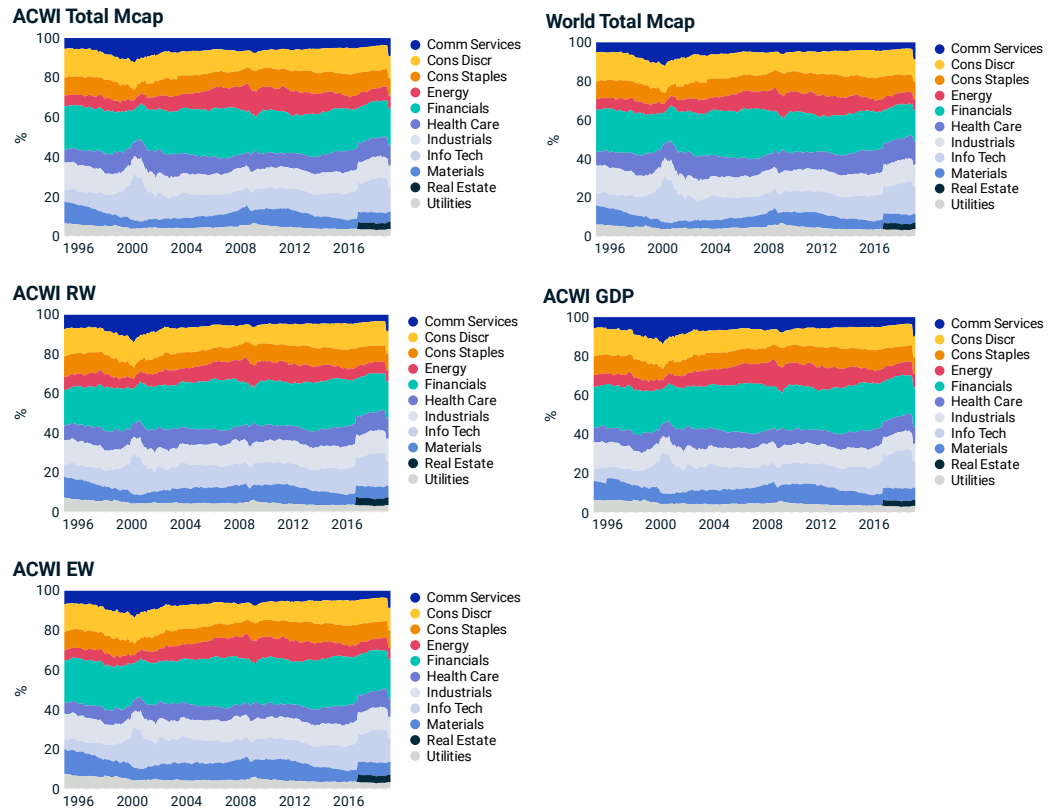


Source: MSCI. Data as of Feb. 28, 2019.

Some differences are worth mentioning: Regional weighting schemes that attribute more capital toward Emerging Markets (GDP weights and EW weights) typically showed a higher concentration in Financials. At the same time, approaches that underweight North America, especially equal weighting and risk weighting, typically showed lower exposure to Information Technology.

Exhibit 85: Historical sector representation of simulated benchmarks





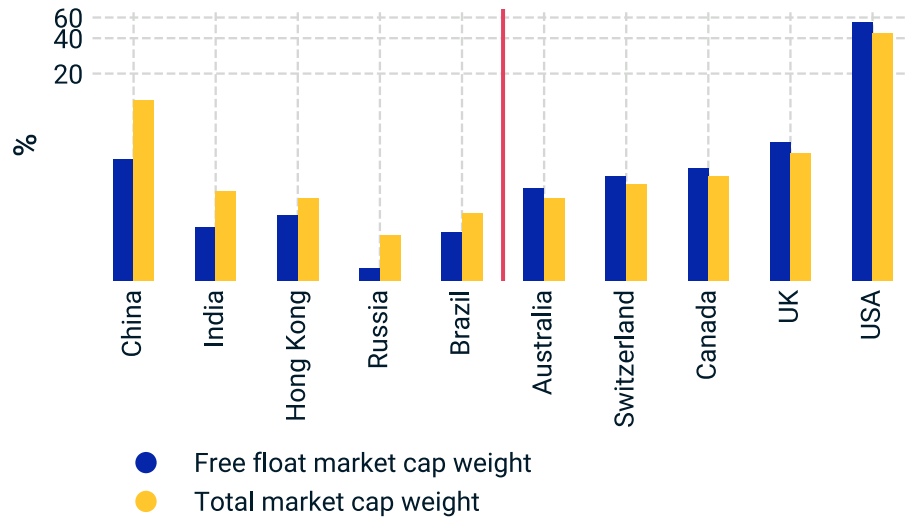
Source: MSCI. Data from Dec. 30, 1994 to Feb. 28, 2019

In summary, the approaches we tested for reweighting regional benchmarks did not lead to extreme sector biases that could impair the representativeness of the benchmark.

Economic versus market cap weights

In section one we highlighted regional differences in average free-float factors as well as differences between regions' GDP and market capitalization weight. To probe deeper, we compare country weights in a total-market weighted ACWI index versus free-float weights (Exhibit 86). It appears that average free-float ratios were much lower in Emerging Market economies (China, India) than in the most developed economies (U.S., U.K.).

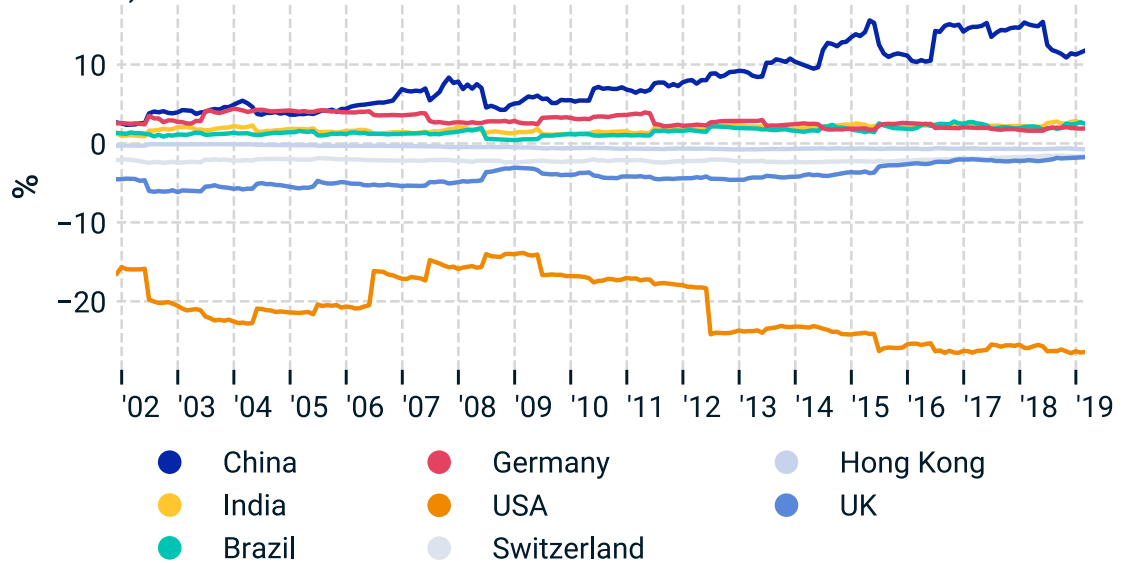
Exhibit 86: Top 10 differences in total market capitalization country weights vs free float adjusted weights



Source: MSCI. Data as of Feb. 28, 2019.

Exhibit 87 extends the analysis of economic versus benchmark weights to countries. Over the past decade, the benchmark weight of USA has continued to increase faster than its GDP weight, whereas the Chinese market weight in the benchmark fell further behind its GDP weight until the partial inclusion of China A shares in 2018, which saw a slight reduction in this discrepancy. In addition, India’s and Germany’s benchmark weights do not fully reflect their weight in global GDP, whereas Switzerland’s and the U.K.’s benchmark weights are larger than their economic weights.

Exhibit 87: Difference between GDP and index weight in MSCI ACWI (selected countries)



Source: MSCI. Data from Nov. 30, 2001 to Feb. 28, 2019.

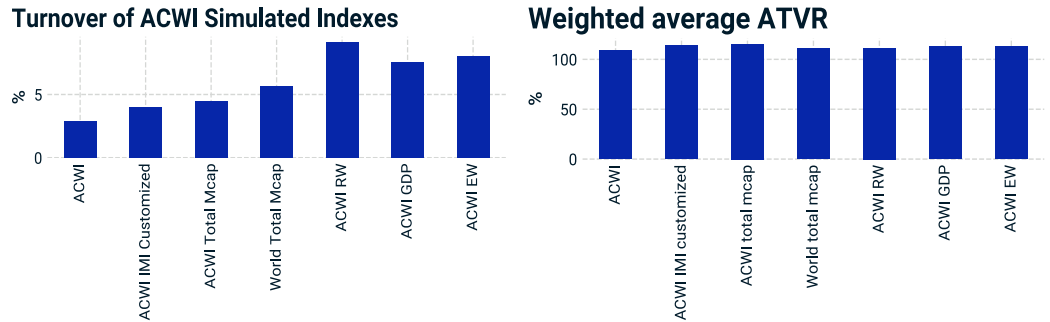
Replicability of the indexes

Apart from representing the underlying equity market, a benchmark should be replicable in an efficient way. Replicability is not only essential for passive investors who want to track an index, but is also important for active managers who use a benchmark as the starting universe for their active portfolio management strategy. Key attributes to compare the replicability of different benchmarks are their liquidity and turnover profiles, which we summarize in Exhibit 88.

Overall, liquidity profiles as measured by index average ATVR²⁹ are similar across all approaches. In addition, all the simulated benchmarks have shown higher turnover than the free-float market cap benchmarks, since they are based on a regional reweighting of the former. However, none of the approaches reaches turnover levels that might impair the replicability of the benchmark.

²⁹ The Annualized Traded Value Ratio (ATVR) used in this report is used to assess the liquidity of securities in benchmarks. ATVR corresponds to the annualized traded value of a security relative to its free float-adjusted market capitalization.

Exhibit 88: Liquidity and turnover comparison

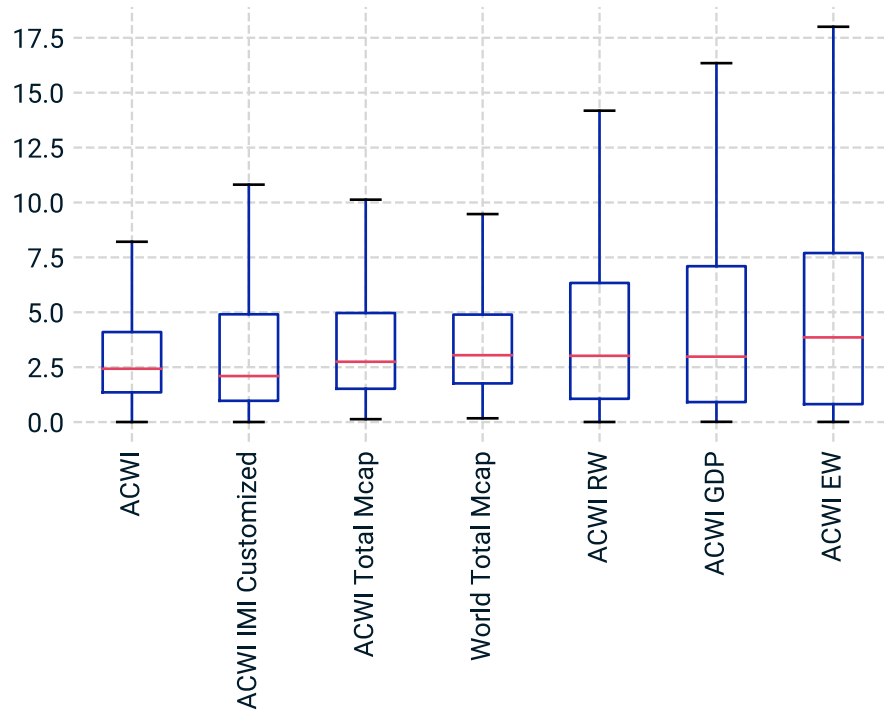


Source: MSCI. Data as of Feb. 28, 2019.

Still, the average liquidity level within benchmarks is only one aspect of index replicability. Passive investors tracking an index may ultimately need to be able to replicate the entire index portfolio.

To determine how far moving away from free-float weights may lead to capacity issues, we compared the capacity of these benchmarks in terms of days to trade the full index portfolio for a given investment amount. The results in Exhibit 89 reveal a more differentiated view than for average liquidity levels. Free-float market capitalization weights were clearly easier to replicate than any of the other weighting schemes, providing empirical evidence for the advantage of their use in benchmark construction. We also observed that equal-weighting and GDP weighting showed the largest reduction in index replicability compared to MSCI ACWI, due to their large underweight in North America and overweight in Emerging Markets.

Exhibit 89: Days to invest USD 100 bn distribution by security³⁰



Source: MSCI. Data as of Feb. 28, 2019.

Performance and risk overview

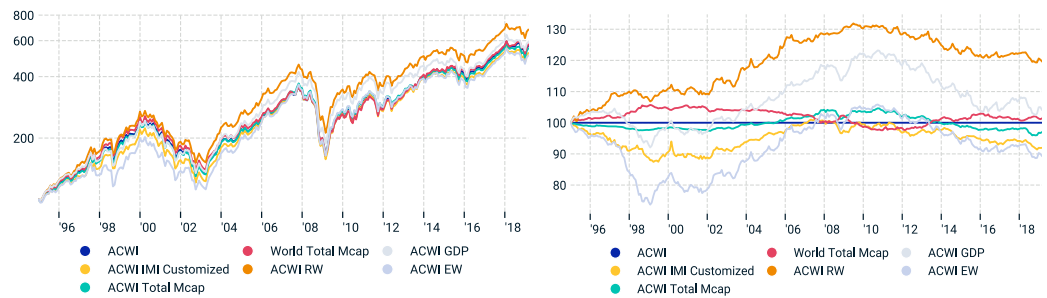
Exhibit 90 compares the simulated results from a performance and risk perspective. Over the study period, the difference in performance between these approaches was driven by their exposure to Emerging Markets during the first half and to North America during the second half. The beginning of the study period (1994-1998) marks the Asian crisis, where the equal weighting approach clearly underperformed due to a relative overweight in Emerging Markets. By contrast, the risk weighting approach outperformed by reducing its exposure to the relatively more volatile Emerging Markets. At the same time, MSCI World total market cap weighting

³⁰ The plot shows average number of trading days needed (red line) and the interquartile range (IQR) defined as the range Q3-Q1 between the 25th percentile Q1 and 75th percentile Q3 (blue box) as well the winsorized minimum and maximum range from $Q1 - 1.5 * IQR$ to $Q3 + 1.5 * IQR$ (black lines).

outperformed in this early period due to its increased weight in North America, where technology stocks drove performance in the second half of 1990s.

However, in the decade leading to the financial crisis (1998-2008), Emerging Markets outperformed Developed Markets and therefore GDP weighting, risk weighting, equal weighting and (to a smaller extent) total market cap weights all outperformed the benchmark, due to a higher share of Emerging Markets exposure. By contrast, the past decade saw North America outperform all other regions and consequently all alternative approaches underperformed due to an underweight in North America. ACWI IMI customized, which is a proxy for GPFG’s current benchmark, outperformed ACWI during the run-up phase to the financial crisis from 2002 to 2008 due to higher exposure to Europe, but underperformed after 2008 due to an underweight in North America.

Exhibit 90: Absolute (left) and relative performance to MSCI ACWI



Source: MSCI. Data from Dec. 30, 1994 to Feb. 28, 2019.

The risk analysis in Exhibit 91 indicates that MSCI World total market-cap weighting showed the lowest level of risk during the study period, due to its lack of Emerging Markets exposure. In addition, of the alternative weighting schemes, risk weighting was the only approach that showed similar risk figures to the benchmark during the study period. Total market capitalization weights, GDP weights and equal weights showed higher levels of risk compared to MSCI ACWI, which was explained by their relative overweight in Emerging Markets (the region with the highest level of risk) and underweight in North America (lowest level of risk).

Exhibit 91: Risk and performance summary

Metrics	ACWI	ACWI IMI Customized	ACWI Total Mcap	World Total Mcap	ACWI RW	ACWI GDP	ACWI EW
Full period return (%)	7.44	7.07	7.31	7.5	8.25	7.63	6.95
5 Yr (%)	6.9	5.4	6.3	6.8	6.2	5.6	5.4
10 Yr (%)	13.3	12.7	12.7	13.3	12.3	12.1	12.0
Sharpe ratio	0.32	0.28	0.3	0.32	0.37	0.31	0.27
Tracking error (%)	0.0	1.59	0.89	1.0	2.11	2.57	3.37
Volatility PA	15.0	15.5	15.3	14.8	15.1	15.9	16.0
VaR @ 99%	-11.9	-12.4	-12.2	-11.0	-11.6	-12.2	-12.5
CVaR @ 99%	-15.4	-16.1	-15.9	-14.8	-15.6	-16.6	-17.0
Max drawdown (%)	58.0	59.6	58.5	53.7	57.2	58.6	58.3
Kurtosis	4.9	5.1	5.0	1.8	4.8	5.0	5.0

Source: MSCI. Data from Dec. 30, 1994 to Feb. 28, 2019. Tracking error is calculated using ACWI as benchmark.

Exhibit 92 shows the active return contribution for each of the three alternative weighting schemes, using MSCI ACWI as benchmark. Currency and country allocations, as well as industry exposures, contributed to performance differentials. There was, however, practically no contribution from liquidity, meaning that the lower level of index replicability observed in Exhibit 89 was not compensated through a liquidity premium. The performance contribution from other equity style factors such as Value or Momentum was also fairly small.

Exhibit 92: Active return attribution

Factor contribution	ACWI Total Mcap	ACWI RW	ACWI GDP	ACWI EW
Active return	-0.14	0.8	0.18	-0.5
Currency	0.09	0.23	0.18	0.37
Countries	-0.08	-0.12	-0.1	-0.16
Industries	-0.08	-0.11	-0.1	-0.19
Value	-0.01	0.04	0.1	0.16
Size	0.01	0.01	-0.01	-0.01
Momentum	0.01	0.03	-0.01	0.01
Quality	0.01	-0.02	0.0	-0.03
Yield	-0.01	0.0	0.0	0.0
Volatility	-0.18	0.02	-0.17	-0.19
Growth	0.0	0.01	0.01	0.01
Liquidity	0.04	-0.02	-0.02	-0.05
Asset selection	0.05	0.79	0.3	-0.42

Source: MSCI. Data from Dec. 30, 1994 to Feb. 28, 2019.

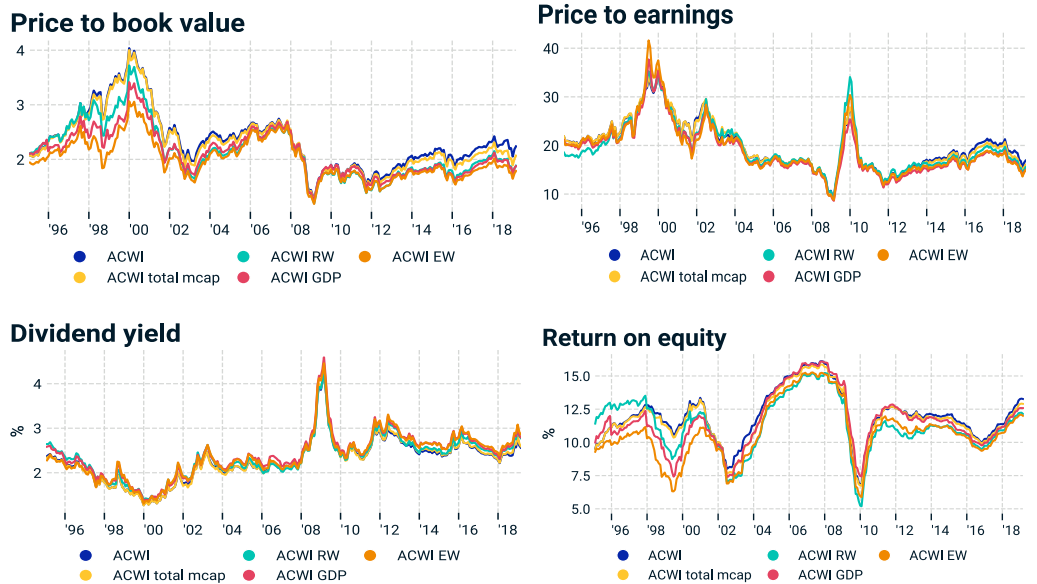
Performance fundamentals

To understand differences in performance and risk, we analyze the underlying market fundamentals in Exhibit 93. In the following, we will focus on comparing the three alternative weighting schemes to ACWI and ACWI total market cap weighting. The free-float market cap benchmark showed the highest valuation levels in terms of price-to-book and also the highest average profitability in terms of RoE during the past decades. In addition, the free-float Mcap benchmark (MSCI ACWI Index) saw the strongest increase in valuation levels during the last decade, due to its exposure to North America, which explains its strong relative performance in this period. By contrast, the equal weighted benchmark (EW) showed the lowest average level of

valuation and profitability, with the lowest relative weight in North America and an overweight in Emerging Markets.

These results also provide insights into in how far the different weighting approaches exposed investors to regional bubbles: At the beginning of the study period (1994-1999), equity markets built up valuation levels that in retrospect were commonly described as a bubble. Naturally, the free-float market cap benchmark, which weights companies according to their cumulative past performance, exposed investors to these valuation levels more than any other benchmark. This led to a decade of underperformance compared to the other approaches after the equity bubble burst.

Exhibit 93: Comparison of market fundamentals



Source: MSCI. Data from Dec. 30, 1994 to Feb. 28, 2019.

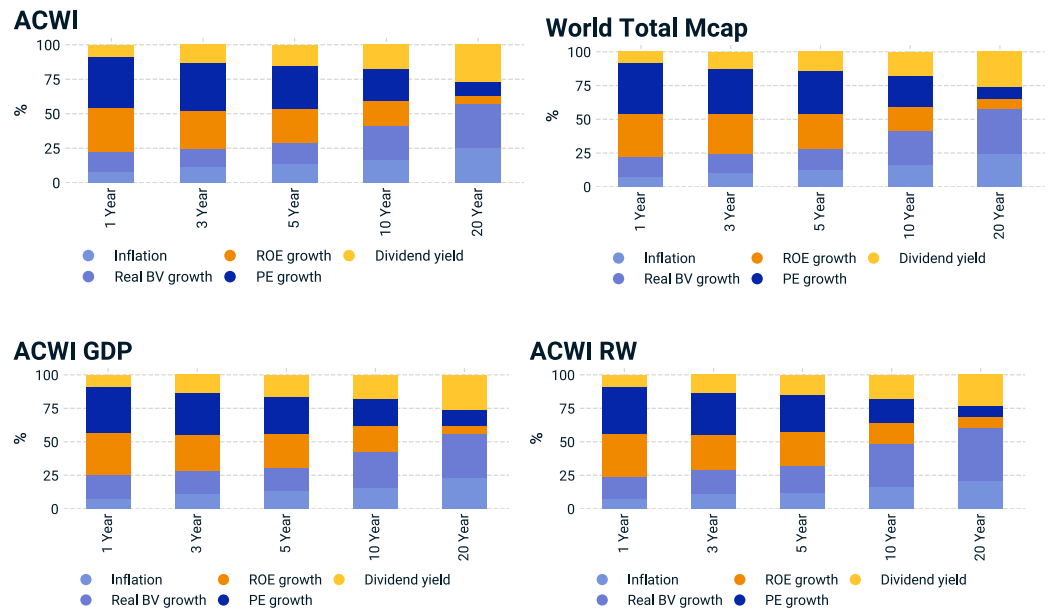
This fundamental analysis shows the two sides of free-float market capitalization benchmarks. On the one hand they showed an efficient allocation of capital toward the most profitable investment opportunities in the market, but on the other they exposed investors to high valuations in market phases when equity prices expanded beyond corporates' growth in profitability.

Performance fundamentals over different time horizons

In section three of this report, we used the book-on-equity model to decompose total equity returns into changes in P/E ratios, changes in RoE, and real changes in book value plus inflation and dividend yield. We observed that over long periods, changes in book value and dividends were the main contributors to equity returns.

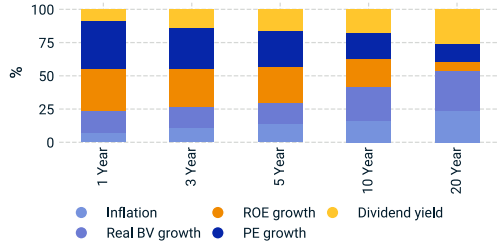
Exhibit 94 shows the same return decomposition over various time horizons for the different variants of global benchmarks. It is interesting to note that over all time periods, the return decomposition of different global benchmarks was very close to MSCI ACWI. Even regional equal weighting showed only a slightly higher return contribution from changes in P/E ratios, due to a higher relative weight to the Pacific region.

Exhibit 94: Book-on-equity return breakdown for MSCI ACWI³¹



³¹ We omitted MSCI ACWI total market cap since the return breakdown was very close to MSCI ACWI.

ACWI EW



Source: MSCI, OECD. Data from Dec. 30, 1994 to Feb. 28, 2019. Inflation data is based on USA inflation (CPI) levels

In brief, while different regional weighting schemes showed clear differences in financial performance, differences in the relative importance of return drivers were fairly small. Over long periods, total equity returns were mostly explained by earnings growth (real growth plus inflation) and dividend yield as shown in Exhibit 95. In a second step, earnings growth can be broken down into changes in book value (real growth plus inflation) and changes in RoE, as shown in Exhibit 96.

Exhibit 95: Book-on-equity return decomposition using earnings growth

Region	Total return	Inflation	PE growth	Earnings growth	Dividend yield
ACWI	6.37	2.18	-0.89	2.74	2.32
ACWI IMI Customized	6.36	2.18	-0.88	2.62	2.44
ACWI Total Mcap	6.33	2.18	-1.06	2.88	2.32
World Total Mcap	6.33	2.18	-0.83	2.67	2.31
ACWI RW	7.09	2.18	-0.84	3.37	2.39
ACWI GDP	6.65	2.18	-1.25	3.26	2.47
ACWI EW	6.53	2.18	-1.31	3.21	2.44

Source: MSCI, OECD. Data from Dec. 30, 1994 to Feb. 28, 2019. Inflation data is based on USA inflation (CPI) levels. Total returns shown are averages of rolling 20-year returns.

Exhibit 96: Book-on-equity return decomposition

Region	Total return	Inflation	Real BV growth	ROE growth	PE growth	Dividend yield
ACWI	6.37	2.18	2.8	-0.05	-0.89	2.32
ACWI IMI Customized	6.36	2.18	2.65	-0.03	-0.88	2.44
ACWI Total Mcap	6.33	2.18	2.96	-0.08	-1.06	2.32
World Total Mcap	6.33	2.18	2.97	-0.3	-0.83	2.31
ACWI RW	7.09	2.18	4.03	-0.66	-0.84	2.39
ACWI GDP	6.65	2.18	3.22	0.04	-1.25	2.47
ACWI EW	6.53	2.18	2.82	0.39	-1.31	2.44

Source: MSCI, OECD. Data from Dec. 30, 1994 to Feb. 28, 2019. Inflation data is based on USA inflation (CPI) levels. Total returns shown are averages of rolling 20-year returns.

In section four, we also used the book-on-equity model to perform fundamental stress tests, which simulated the risk of a potential downturn in the financial trajectory of regional equity markets. To be precise, we applied the historical worst-case drop in book value and the worst-case drop in price-to-book value ratios to current equity markets. Exhibit 97 extends this analysis to the simulated benchmarks. The results show that hypothetical simulated losses were clearly smaller for GDP weighting, risk weighting and equal weighting, mainly due to their lower exposure to North America, where the fundamental stress test results found in section four were more severe than in EMEA and Pacific.

Exhibit 97: Fundamental stress test of simulated benchmarks

Stress Test	ACWI	ACWI IMI Customized	ACWI Total Mcap	World Total Mcap	ACWI RW	ACWI GDP	ACWI EW
Book Value	-15.50	-16.33	-14.92	-15.81	-12.78	-15.03	-14.82
Price to Book Value	-44.30	-42.53	-40.18	-46.16	-36.58	-34.62	-33.82
Yield	1.27	1.33	1.27	1.26	1.36	1.33	1.31
Historical Min	-58.53	-57.43	-53.84	-60.72	-48.01	-48.32	-47.33

Source: MSCI. Data from Dec. 30, 1994 to Feb. 28, 2019.

As in section four, we also simulated fundamental stress tests that apply the largest historical relative fall in PB ratios (Exhibit 98). Similar to the results found in section four, the hypothetical losses in this scenario exceeded those in Exhibit 97, because PB ratios may fall below their historical minimum.

Exhibit 98: Fundamental stress test of simulated benchmarks (relative fall in PB)

Stress Test	ACWI	ACWI IMI Customized	ACWI Total Mcap	World Total Mcap	ACWI RW	ACWI GDP	ACWI EW
Book Value	-15.50	-16.33	-14.92	-15.81	-12.78	-15.03	-14.82
Price to Book Value	-69.11	-61.38	-64.07	-67.89	-68.09	-71.34	-69.09
Yield	1.27	1.33	1.27	1.26	1.36	1.33	1.31
Historical Min	-58.53	-57.43	-53.84	-60.72	-48.01	-48.32	-47.33

Source: MSCI. Data from Dec. 30, 1994 to Feb. 28, 2019.

Diversification and concentration risk

A key motivation for assessing different regional weighting schemes is the potential for improvements in diversification. We assess two aspects of diversification: First, diversification defined as a reduction in levels of market risk, which can be measured by the diversification ratio. This is a relatively short-term view of diversification, because the effect is immediately evident in portfolio volatility. Second, diversification by way of averaging out differences in the long-term growth trajectories of different regions. This long-term view of diversification can be measured by differences in regional concentration risks.

Starting with the short-term view of diversifying market risks, Exhibit 99 and Exhibit 100 compare total diversification ratios and their breakdown into contributions from regions, countries and securities. Three observations stand out: First, total market cap weights and free-float market cap weights showed the lowest level of diversification, especially compared to GDP weights and EW weights. Second, the differences were cyclical and were typically highest in calm markets and lowest in stressed markets, when diversification was most needed. Third, overall the additional level of diversification that could be obtained from alternative regional weighting schemes was relatively small.

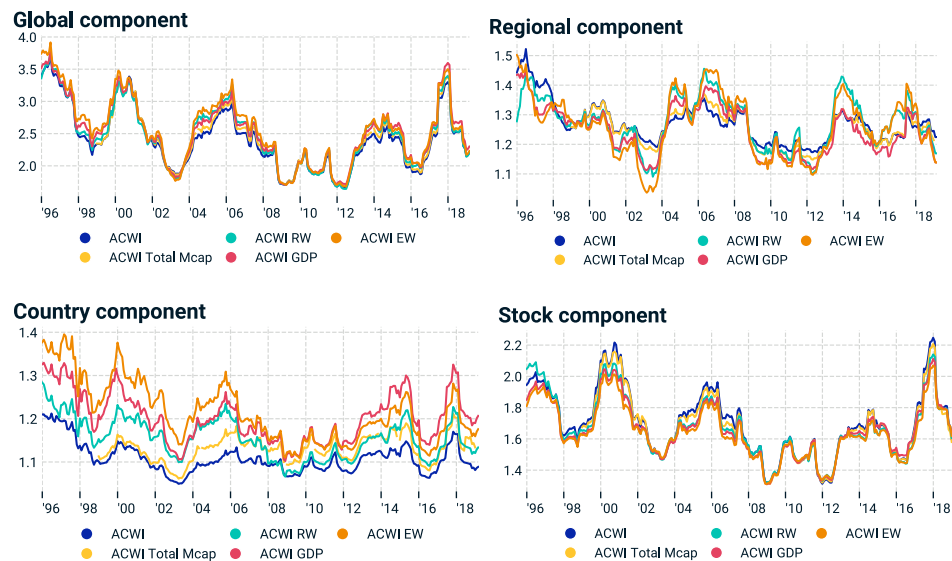
Exhibit 99: Comparison of average diversification ratios and contributions

Index	Global	Regional	Country	Stock
ACWI	2.42	1.27	1.11	1.7
ACWI IMI Customized	2.53	1.28	1.13	1.74
ACWI Total Mcap	2.38	1.25	1.13	1.67
World Total Mcap	2.33	1.26	1.08	1.71
ACWI RW	2.48	1.27	1.16	1.67
ACWI GDP	2.52	1.25	1.2	1.66
ACWI EW	2.56	1.26	1.22	1.64

Source: MSCI. Data from Dec. 29, 1995 to Feb. 28, 2019.

This is in line with the findings in sections one and three, where we saw that stock diversification was the main contributor to the global diversification ratio: Ultimately, all the weighting schemes we tested were based on the same universe of stocks.

Exhibit 100: Comparison of diversification ratios



Source: MSCI. Data from Dec. 29, 1995 to Feb. 28, 2019.

Next, Exhibit 101 compares portfolio concentration risks as measured by the Gini coefficient. All approaches show lower levels of concentration risk compared to

MSCI ACWI, with total market cap weights and GDP weights showing the highest level of portfolio granularity.

Exhibit 101: Comparison of Gini coefficients for stock concentration risk

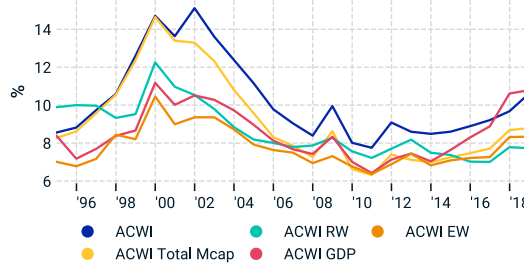
Portfolio	1998	2003	2008	2013	2018
ACWI	0.71	0.64	0.58	0.58	0.61
ACWI IMI Customized	0.66	0.65	0.67	0.67	0.66
ACWI Total Mcap	0.71	0.6	0.55	0.54	0.54
World Total Mcap	0.56	0.56	0.56	0.56	0.56
ACWI RW	0.67	0.58	0.57	0.54	0.59
ACWI GDP	0.64	0.57	0.55	0.52	0.56
ACWI EW	0.64	0.57	0.55	0.53	0.57

Source: MSCI.

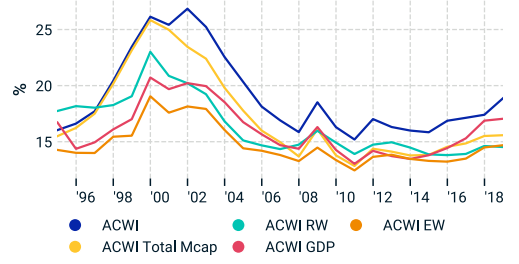
We see very similar results when looking at the weight of the largest 10 or 25 index constituents and the effective number of stocks and countries (measuring country concentration risks) in Exhibit 102. Free-float market capitalization weights clearly resulted in the highest level of risk concentration, while GDP weights and RW showed the greatest reduction in concentration risk, especially in the effective number of stocks and countries.

Exhibit 102: Comparison of security and country diversification

Weight of top 10 constituents

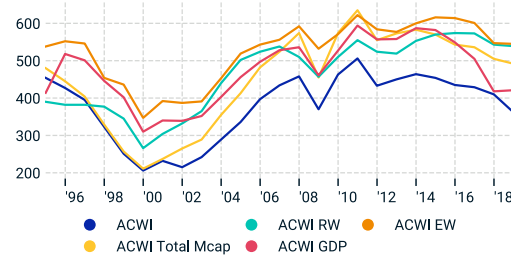


Weight of top 25 constituents

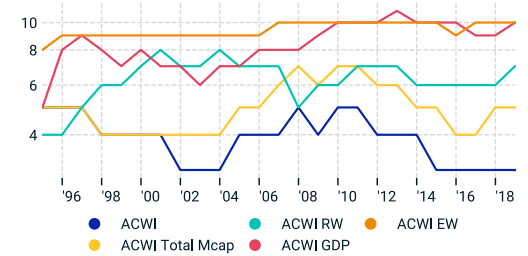


Source: MSCI. Data From Dec. 30, 1994 to Dec. 31, 2018.

Effective number of stocks



Effective number of countries

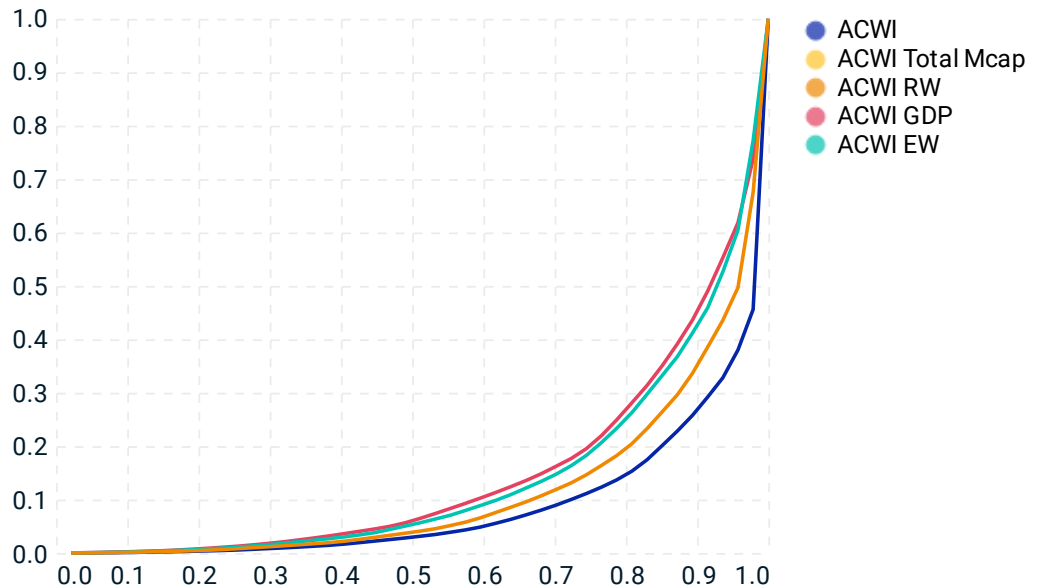


*Effective number of stocks is calculated as one over the Herfindahl index.
Source: MSCI. Data from Dec. 30, 1994 to Dec. 31, 2018.

It is important to emphasize that the reduction in constituent and country concentration risk that alternative weighting schemes provide compared to free-float market cap weights is much more significant than the reduction in diversification ratios seen above. For long term investors, the reduction in concentration risk may be more relevant: While diversification ratios measure the reduction in current levels of market risk as measured by volatility due to diversification, the reduction in country risks can be an effective way to reduce the risk exposure to high prices in specific countries or regions, such as the stock market bubble in Japan in the 1980s. In summary, less regional concentration may help average out regional differences in long-term growth trajectories.

To probe deeper into differences in country concentration risk, Exhibit 103 compares the different weighting schemes in terms of their country Lorenz concentration curve. Clearly, MSCI ACWI has been the most concentrated index by country, with GDP weighting and equal weighting offering the strongest relative improvement in country diversification.

Exhibit 103: Comparison of country level Lorenz concentration curves



Source: MSCI. As of Dec. 31, 2018.

Regional allocation and implied returns

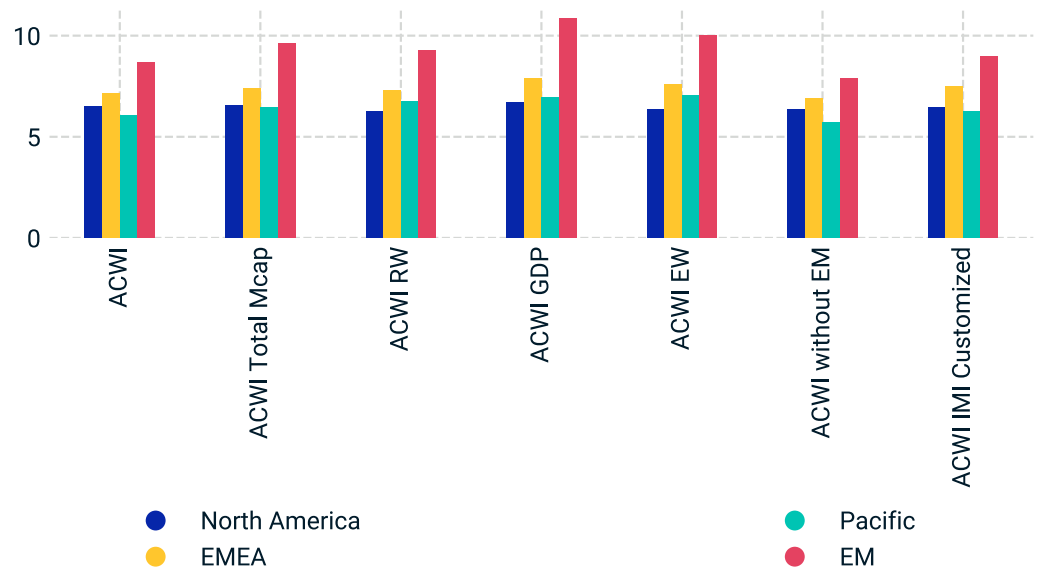
Institutional investors may seek to understand how far investment risks in Emerging Markets have been compensated by equity returns. We will use the concept of implied returns as proposed by Black and Litterman (1992), which derives a market implied vector of asset returns based on three input parameters: A covariance model describing stock correlations, the vector of asset weights in the portfolio and a market’s risk aversion coefficient (defined as the market’s equity risk premium over the its variance).

For our simulation, we use the covariance matrix of the MSCI Global Equity Model for Long-Term Investors (GEMTL³²) and the benchmark weights for each simulation as input parameters. Exhibit 104 shows the resulting implied equity returns. For all scenarios, Emerging Markets show the highest level of market implied returns,

³²Details can be found in “Model Insight - Barra Global Equity Model – Empirical Notes”.

reflecting that investors expect to be compensated for the higher level of market risks seen in Emerging Markets.³³

Exhibit 104: Market implied returns using the Black-Litterman model



Source: MSCI. Data as of Feb. 28, 2019.

Regional versus country-based benchmarks

In the above analysis, we created benchmarks based on a prudent approach of regional reweighting. However, investors may be interested in assessing benchmarks created by reweighting countries, to see how far this may help to improve diversification beyond regional re-weighting. Therefore, we now compare equal regional weighting (“ERW”) to equal country weighting (“ECW”). The corresponding

³³ This report may contain analysis of historical data, which may include hypothetical, backtested or simulated performance results. There are frequently material differences between backtested or simulated performance results and actual results subsequently achieved by any investment strategy.

The analysis and observations in this report are limited solely to the period of the relevant historical data, backtest or simulation. Past performance – whether actual, backtested or simulated – is no indication or guarantee of future performance. None of the information or analysis herein is intended to constitute investment advice or a recommendation to make (or refrain from making) any kind of investment decision or asset allocation and should not be relied on as such.

regional and largest country weights are shown in Exhibit 105: Equal country weighting leads to a much more extreme regional reweighting than equal regional weighting, particularly due to the large underweight in North America and clear overweight in Emerging Markets. Therefore, equal country weighting does not fulfill the representativeness criteria for a global benchmark.

Exhibit 105: Comparison of regional and country weights

Country weights (%)

Country	ACWI	ACWI ERW	ACWI ECW
USA	54.85	23.23	2.05
Japan	7.32	16.25	2.02
Uk	5.18	6.76	2.08
China	3.75	8.21	2.19
France	3.41	4.45	2.13
Canada	3.1	1.31	2.18
Switzerland	2.67	3.48	2.12
Germany	2.66	3.47	2.07
Australia	2.11	4.72	2.13
Korea	1.6	3.5	2.12

Region weights (%)

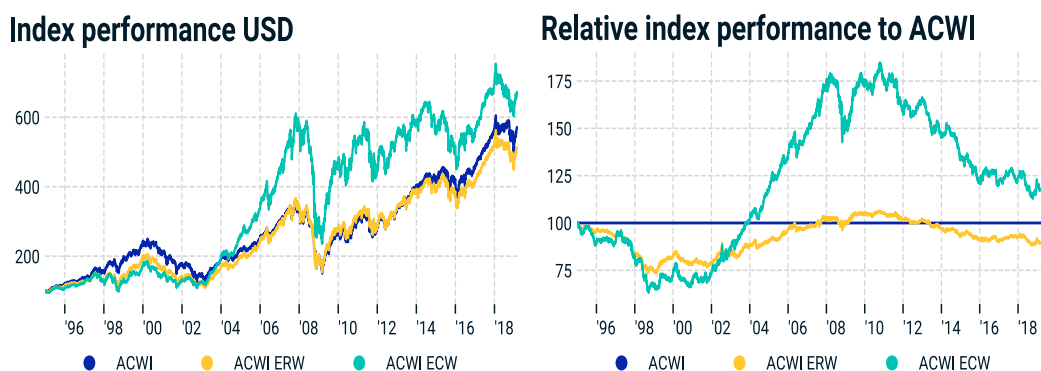
Region	ACWI	ACWI ERW	ACWI ECW
North America	57.95	24.54	4.22
EMEA	19.25	25.12	33.66
Pacific	11.14	24.79	10.76
EM	11.66	25.55	51.35

Source: MSCI. Data as of Feb. 28, 2019.

While equal country weighting may be too extreme in practice, it may still provide a useful insight: It shows the maximum level of diversification one can expect from diversifying country exposures. Therefore, we ignore potential problems in terms of the representativeness and replicability of country equal weighting in the following analysis and focus on implications for risk, return and diversification.

To start with, Exhibit 106 and Exhibit 107 show a performance and risk comparison.

Exhibit 106: Performance comparison of country and regional equal weighting



Source: MSCI. Data from Dec. 30, 1994 to Feb. 28, 2019.

Country equal weighting had more than double the tracking error of regional equal weighting, which was also reflected in its performance relative to the benchmark: In the first half of the study period, country equal weighting showed strong outperformance due to a much higher exposure to Emerging Market equities.

However, during the second half, the significant underweight in North America led to considerable underperformance. In addition, despite the increase in country diversification, country equal weighting showed higher average volatility and higher tail risks (drawdown and CVaR).

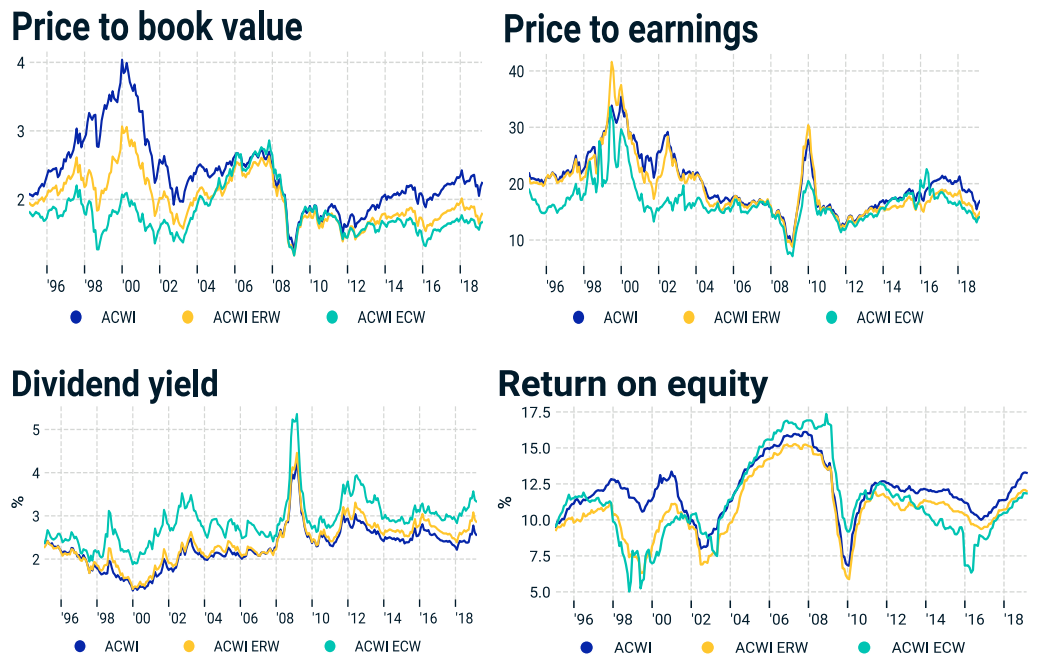
Exhibit 107: Performance / risk comparison of country and regional equal weighting

Metrics	ACWI	ACWI ERW	ACWI ECW
Full period return (%)	7.44	6.95	8.15
5 Yr (%)	6.9	5.4	2.1
10 Yr (%)	13.3	12.0	10.3
Sharpe ratio	0.32	0.27	0.3
Tracking error (%)	0.0	3.37	7.46
Volatility PA	15.0	16.0	18.3
VaR @ 99%	-11.9	-12.5	-14.5
CVaR @ 99%	-15.4	-17.0	-21.0
Max drawdown (%)	58.0	58.3	61.3
Kurtosis	4.9	5.0	5.9

Source: MSCI. Data from Dec. 30, 1994 to Feb. 28, 2019.

Looking at fundamental risk and return drivers in Exhibit 108, we observe that country equal weighting had a similar but stronger fundamental effect to regional equal weighting: Valuation levels (price-to-book and price-to-earnings) and return-on-equity ratios were even lower for equal country weighting, while dividend yields were higher. At the same time, country equal weighting reduced the cyclicality of valuation levels even more than regional equal weighting. This confirms the observation from the previous regional comparison that on the one hand equal weighting resulted in less profitable investments (in terms of RoE), but on the other it helped to average out fundamental differences in regions and countries.

Exhibit 108: Comparison of fundamental performance drivers

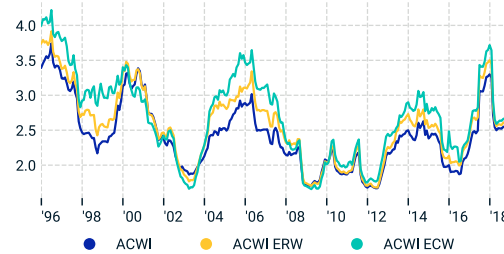


Source: MSCI. Data from Dec. 30, 1994 to Feb. 28, 2019.

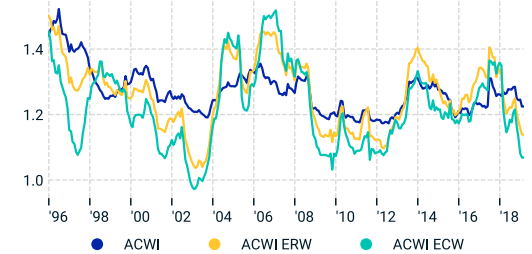
Next, we look at the diversification ratios in Exhibit 109. On average, country equal weighting provided more additional diversification benefit than regional equal weighting, due to a clear increase in country diversification. However, as observed above, the additional diversification benefit was smallest during turbulent markets, when diversification may have been needed most.

Exhibit 109: Comparison of diversification ratios

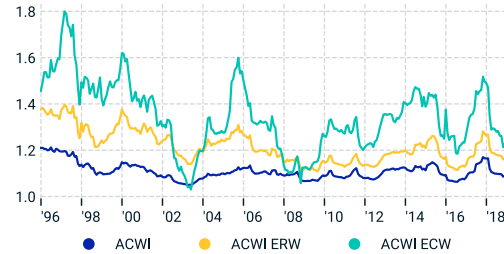
Global component



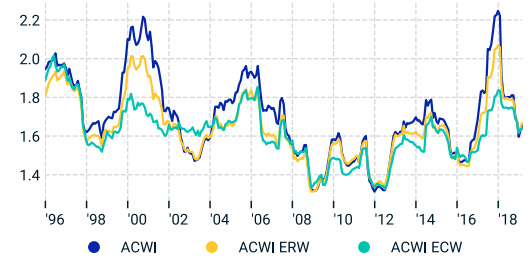
Regional component



Country component



Stock component



Source: MSCI. Data from Dec. 29, 1995 to Feb. 28, 2019.

Overall, country equal weighting is an enhanced version of regional equal weighting, showing similar but stonger characteristics: There was a clear improvement in terms of diversifying differences in global fundamental trajectories, whereas the additional diversification benefits in terms of short term volatility were relatively small.

Combining benchmark approaches

The purpose of the previous simulations was to highlight differences in risk, diversification and performance across different benchmarking approaches. However, in practice some of these approaches may be combined to represent the current liquid opportunity set in global equity markets while simultaneously allowing for a reduction in concentration risks and the possibility to access market growth opportunities, as shown in the example in the Appendix.

Summary of key observations

- Alternative benchmarks should be assessed in terms of their representativeness of the market, their performance and risk characteristics and their potential diversification benefits.
- To produce meaningful benchmarks that were representative of global equity markets, we used regional free-float market capitalization benchmarks as building blocks and focused on reweighting the four regions. Our analysis showed that this cautious approach preserved the basic requirements of representativeness. However, we observed some trade-off in terms of index replicability on the one hand and greater uniformity of regional weights on the other. We also observed that during our study period, lower relative levels of replicability were not compensated by a liquidity premium.
- The simulated benchmarks had very different levels of tracking error against MSCI ACWI, with the total market-cap benchmark coming closest and the EW index showing the highest level of tracking error. There was a clear difference in regional allocation across these benchmarks, with the GDP-weighted benchmark and EW in particular attributing significantly more weight to Emerging Markets and less to North America.
- While all tested approaches showed relatively similar exposures to EMEA and Pacific, the main difference was in the allocation to North America versus Emerging Markets. On the one hand, MSCI World total market-cap weighting and ACWI free-float weights attributed the highest weight to North America and the lowest to Emerging Markets. On the other hand, equal weighting created the largest active underweight in North America and a clear active overweight in EM.
- The performance differences seen in these simulated benchmarks were mainly explained by their regional allocation: The outperformance of EW in the decade before the financial crisis was explained by a clear overweight in EM compared to all other simulations. Analogously, the performance drag in the past eight years was due to a clear underweight in North America. For GDP and Total cap weighted indexes, we observed a similar regional pattern – relative overweight in EM and underweight in North America – but with smaller active weights and therefore a smaller tracking error and performance impact.
- The difference in fundamentals was also explained by the difference in the regional allocation: As the past decade saw the strongest expansion of valuation ratios in North America, the simulated benchmarks showed lower valuation levels in line with their underweight in North America. EW showed the lowest

average valuation levels. In the fundamental analysis, the free-float market capitalization benchmark was the most efficient in terms of allocating capital to the most profitable companies. However, it was also the approach that showed the greatest risk of being exposed to higher levels and regional discrepancies in equity prices.

- Overall, EW saw the most stable/least volatile behavior of fundamentals across the business cycle. This was in line with the more stable allocation of capital across countries and regions, which avoided overweighting regions that had shown outperformance for some time and were therefore overweight in capitalization-based benchmarks. On the other hand, MSCI ACWI saw the most cyclical behavior of fundamentals over time.
- Looking at diversification ratios, the GDP-weighted and the EW benchmark in particular showed higher levels of diversification ratios than both ACWI and the total Mcap benchmark, but with a similar cyclical pattern. This was explained by higher contributions from country and regional diversification and was in line with our intuition, since these benchmarks avoid regional concentrations such as North America. However, while average levels of diversification were higher for these two simulated benchmarks, the increase in diversification was quite small in crisis situations, when diversification was typically most needed.
- The improved diversification profile of EW and GDP-weighted benchmarks did not result in lower risk figures (volatility, VaR, drawdowns). By contrast, differences in the risk profile were explained by differences in regional allocation: EW showed the highest level of risk due to the largest weight allocation to Emerging Markets, whereas MSCI ACWI, with its largest weight in North American equities, showed the lowest level of risk.

6. Alternative indexes for Emerging Markets

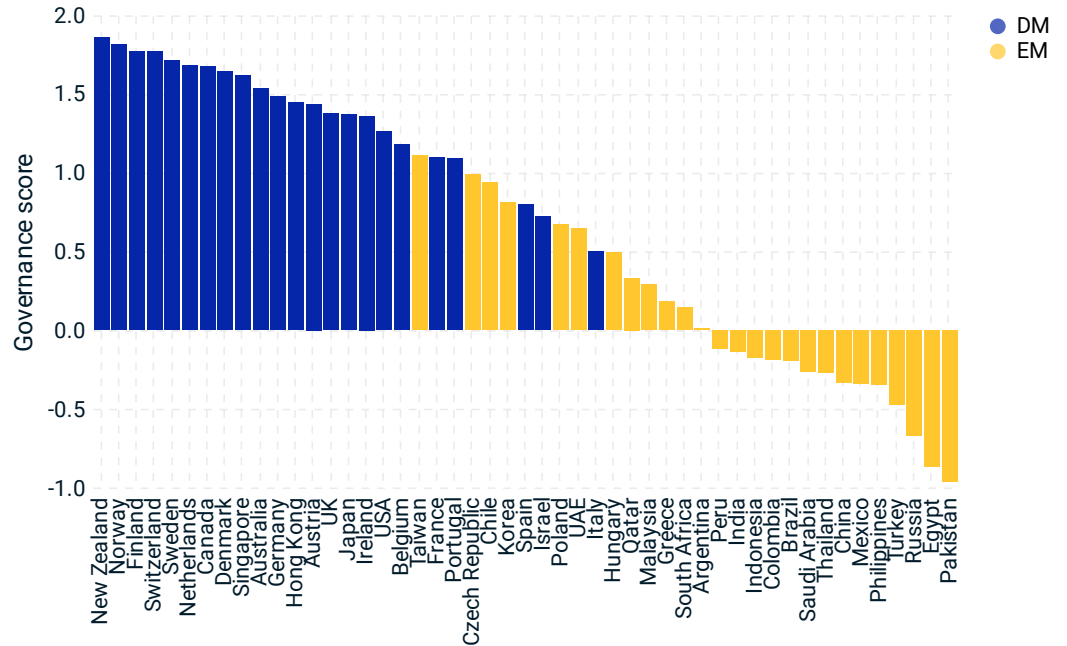
MSCI Emerging Markets IMI targets a 99% market capitalization coverage in large caps, mid caps and small caps. In this section we will simulate and assess alternative Emerging Markets indexes along three dimensions:

- Reducing the target coverage level of MSCI Emerging Markets IMI.
- Reducing the number of countries covered by omitting smaller, less liquid markets or markets with low levels of governance.
- Capping the largest country weights in MSCI Emerging Markets IMI to mitigate country concentration risks.

In each of these simulations we will assess the potential impact on risk and return characteristics. In this respect, it is worth mentioning that in section three of this report we found that dispersion in country equity returns was larger in Emerging Markets than in Developed Markets, which means historically diversifying country risks was even more important in EM than in DM. In addition, our analysis of country equity risk premia showed that historically risk premia in Emerging Markets compensated investors for investing in smaller, less liquid markets with lower levels of governance (as measured by the World Bank Governance score).

For the analysis in this section, it is important to highlight that countries in Emerging Markets clearly displayed lower levels of World Bank Governance scores, as shown in Exhibit 110, which illustrates that governance related investment risks may be higher in EM than in DM.

Exhibit 110: Distribution of Governance scores within DM and EM

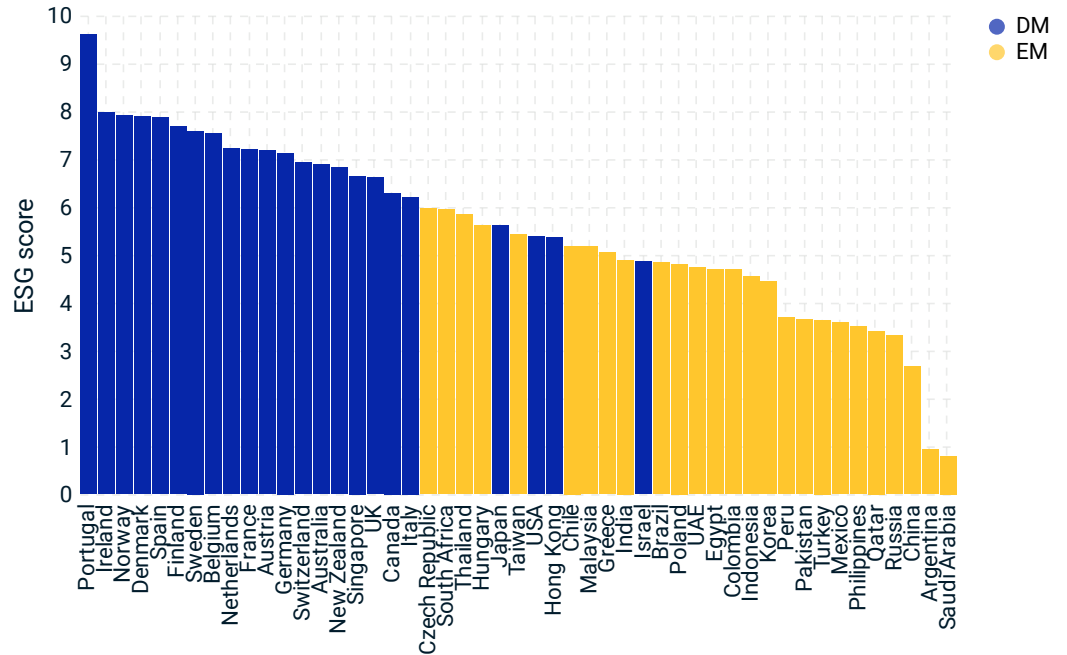


Source: MSCI. Data as of Feb. 28, 2019.

In addition, Exhibit 111 shows the distribution of MSCI ESG Government Ratings within DM and EM. MSCI ESG Government Ratings look at sovereign risks in a broader sense, i.e., the assessment includes governance risks but also sovereigns' exposure to environmental issues such as climate change and social issues. They are not based on MSCI ESG Ratings for corporates. The distribution of country ratings shows a clear regional difference, with DM countries on average scoring higher than EM countries.

It is also interesting to note that in both measures – World Bank Governance scores and MSCI ESG Government Ratings – Developed European countries on average score higher than countries in North America and in the Pacific region.

Exhibit 111: Distribution of MSCI ESG Country Ratings



Source: MSCI. Data as of Feb. 28, 2019.

Market coverage and the size premium in the MSCI EM Index

To start with, we assess potential ways to create more narrowly defined Emerging Markets benchmarks in terms of market coverage. Therefore, we compare the MSCI Emerging Markets IMI benchmark, which covers 99% of the market, to simulated versions targeting 98%, 97%, 95% and 90% coverage respectively. We use the MSCI EM index as the benchmark in Exhibit 112. Each percentage point reduction in market coverage reduced the number of shares by about 300.

The reduction in coverage level was accompanied by a slight reduction in outperformance over the MSCI EM Index. This means that during our study period the smaller-sized small caps contributed to outperformance. Investors looking for a more narrowly defined benchmark in Emerging Markets faced a slight trade-off between market coverage and performance during the study period.

At the same time, all benchmark variants showed similar levels of tracking error and index liquidity.

Exhibit 112: Comparison of market coverage levels for Emerging Markets

Metrics	EM*	EM IMI 90 pct	EM IMI 95 pct	EM IMI 97 pct	EM IMI 98 pct	EM IMI
Total return (%)	4.89	5.01	5.04	5.03	5.02	5.12
Total risk (%)	22.41	22.18	22.14	22.12	22.11	22.09
Return/risk	0.22	0.23	0.23	0.23	0.23	0.23
Tracking error (%)	0.0	1.45	1.6	1.67	1.71	1.62
Avg no of stocks	746.0	1097.0	1573.0	1881.0	2089.0	2437.0
Effective no of stocks	177.0	197.0	220.0	229.0	234.0	242.0
ATVR (%)	124.65	129.03	132.06	132.97	133.25	133.52
Gini coefficient	0.59	0.53	0.56	0.58	0.59	0.62

Source: MSCI. Data from Dec. 30, 1994 to Feb. 28, 2019.

*GIMI Methodology applied prior to June 2008.

Country selection for Emerging Markets

The motivation for looking at Emerging Markets benchmarks that are simplified in terms of country coverage is twofold: To reduce the benchmark’s exposure to markets and countries that display high levels of governance risks, and to potentially improve replicability by focusing on larger and more liquid markets.

To identify countries that we might drop from the benchmark universe, we consider the following three macro indicators and two market indicators:

Macro indicators:

1. 5-year GDP growth forecast according to IMF
2. Current account deficit / GDP according to IMF
3. The country governance score as defined in section three of this report

Market indicators:

1. Market capitalization in USD
2. Market liquidity (ATVR)

The economic rationale for the choice of macro indicators is the observation that Emerging Markets are expected to outgrow Developed Markets (see section one), but with a high level of growth dispersion: some countries in Emerging Markets have lagged in their economic growth and therefore there is a high risk that their equity

markets may not provide attractive risk premia going forward. The inclusion of governance risk is important as investors may face risks in Emerging Markets they may not have met in Developed Markets: for instance, the risk of market disruption or the introduction of capital controls (see section eight of this report for details). While our analysis in section three of this report showed that historically governance risks contributed to equity risk premia, some investors may prefer a slightly lower expected overall equity risk premium in exchange for less exposure to these risks.

The economic rationale for the choice of market indicators is their suitability for assessing ways to focus capital on larger and more liquid markets.

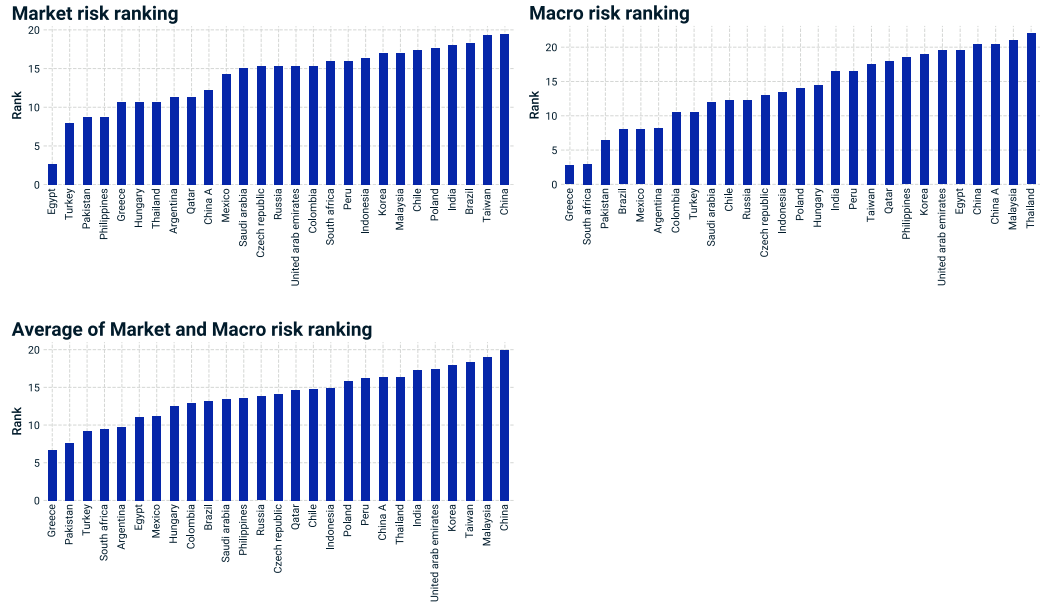
We aggregate these five indicators using the following three steps:

1. We rank Emerging Markets countries according to each of these five indicators, attributing rank numbers 1, 2, 3....
2. We sum rank numbers for the macro indicators into one aggregated Macro Risk Ranking and rank numbers of the market indicators into one aggregated Market Risk Ranking.
3. We sum the Macro Risk Ranking and Market Risk Ranking per country into one aggregated Average Country Ranking.

The basic rationale for this method is giving equal weight to macro and market risks in order to obtain an overall risk ranking of countries. The Market Risk Ranking, Macro Risk Ranking and Average Country Ranking are shown in Exhibit 113.

Importantly, for the Market Risk Ranking we used separate rankings for the Chinese market and the market for China A shares, to reflect differences in market size and liquidity. Moreover, we did not include Argentina in the subsequent simulations because it only entered the MSCI Emerging Markets IMI in June 2019.

Exhibit 113: Macro and market risk ranking of Emerging Markets



Source: MSCI. Market risk ranking: World Bank Data as of Dec. 31, 2018 (extrapolated). Macro risk ranking: IMF data is the average of IMF predicted country indicators for 2019 to 2024.

We now assess how the risk and diversification profile of an Emerging Markets benchmark may change when we exclude countries at the lower end of the overall country risk ranking. To be precise, we simulate three scenarios by removing countries from the lower end of the overall country risk ranking, as shown in Exhibit 114.

Exhibit 114: Scenarios: countries and weights excluded from EM IMI

EM IMI Scenario 1	EM IMI Scenario 2	EM IMI Scenario 3
Pakistan - 0.12%	Pakistan - 0.12%	Pakistan - 0.12%
Greece - 0.32%	Greece - 0.32%	Greece - 0.32%
Turkey - 0.74%	Turkey - 0.74%	Turkey - 0.74%
	South Africa - 6.04%	South Africa - 6.04%
	Egypt - 0.19%	Egypt - 0.19%
		Mexico - 2.72%
		Hungary - 0.30%

Source: MSCI. Data as of Feb. 28, 2019.

The risk and performance profiles of these simplified Emerging Markets benchmarks are summarized in Exhibit 115.

The countries excluded in Scenario 1 were relatively small and therefore the impact on the number of securities and the overall market coverage was relatively limited, but this was clearly larger in Scenarios 2 and 3. We also observed a slight decrease in historical performance, which was in line with our observation in section three that historically country equity risk premia rewarded investors for investing in smaller equity markets with weaker governance. In addition, we observed a slight increase in risk in all three scenarios, which may be due to a reduction in diversification. Therefore, removing markets that face higher levels of macro and market risk reduced the equity risk premium of the benchmark slightly. As a consequence, we also observed a slight increase in portfolio concentration, as measured by the effective number of stocks and the Gini coefficient.

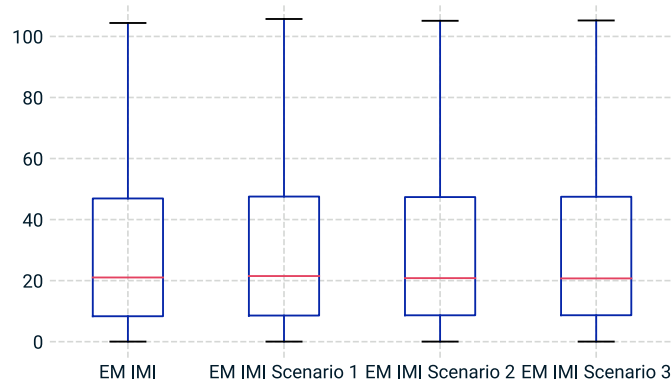
Exhibit 115: Simulated simplified Emerging Markets benchmarks

Metrics	EM IMI	EM IMI Scenario 1	EM IMI Scenario 2	EM IMI Scenario 3
Total return (%)	5.12	4.99	4.87	4.45
Total risk (%)	22.09	22.31	22.43	22.69
Return/Risk	0.23	0.22	0.22	0.2
Tracking error (%)	0.0	1.83	2.09	2.65
VaR @ 99%	-17.24	-17.5	-17.79	-17.99
CVaR @ 99%	-24.41	-24.34	-24.23	-23.93
Avg no of stocks	2437.0	2295.0	2277.0	2214.0
Effective no of stocks	242.0	226.0	216.0	204.0
ATVR (%)	133.52	129.16	131.25	135.03
Gini coefficient	0.62	0.62	0.62	0.62

Source: MSCI. Data from Dec. 30, 1994 to Feb. 28, 2019.

There was also a slight decrease in index liquidity in scenario one and two. To analyze this deeper, Exhibit 116 looks at index replicability as measured by the number of days to trade the index portfolio. It is interesting to note that – despite the removal of less sophisticated markets such as Pakistan – index replicability was fairly close to benchmark.

Exhibit 116: Days to trade USD 100 bn³⁴



Source: MSCI. Data as of Feb. 28, 2019.

Overall, removing less sophisticated markets can be a way to mitigate country and market governance risks. At the same time, during our study period we observed a trade-off between the reduction of country risk on the one hand and equity risk premia on the other hand.

Country capping for Emerging Markets

In section two of this report we identified concentration risks in regional equity markets at both a country level and stock level. Country concentration risks are especially important in Emerging Markets, where political risks and risks with respect to market governance may be more severe than in Developed Markets.

One way to mitigate country concentration risks is to cap country weights in the weighting scheme. Therefore, we will simulate three indexes in the following:

- MSCI Emerging Markets IMI with a 10% cap on country weights
- MSCI Emerging Markets IMI with a 20% cap on country weights
- MSCI Emerging Markets IMI with a 30% cap on country weights

³⁴ The plot shows average number of trading days needed (red line) and the interquartile range (IQR) defined as the range Q3-Q1 between the 25th percentile Q1 and 75th percentile Q3 (blue box) as well the winsorized minimum and maximum range from $Q1 - 1.5 * IQR$ to $Q3 + 1.5 * IQR$ (black lines).

The simulation results in Exhibit 117 show that the application of 20% and 30% caps had relatively small financial effects with levels of tracking error below 1% and risk and performance figures as well as concentration risk (effective number of stocks) very close to benchmark. However, the application of a 10% weight cap resulted in a much higher tracking error and at the same time reduced the risk of the portfolio and improved diversification (effective number of stocks). During the study period, the financial performance of the 10% capped index was also improved. At the same time, we observed a clear increase in the index turnover, which was highest for the 10% capped simulation.

Exhibit 117: Simulation of MSCI Emerging Markets IMI with different country caps

Metrics	EM IMI	EM IMI 10% Cap	EM IMI 20% Cap	EM IMI 30% Cap
Total return (%)	5.12	6.01	5.04	5.0
Total risk (%)	22.09	21.72	22.07	22.11
Return/Risk	0.23	0.28	0.23	0.23
Tracking error (%)	0.0	2.45	0.91	0.8
VaR @ 99%	-17.24	-16.47	-17.25	-17.25
CVaR @ 99%	-24.41	-23.81	-24.42	-24.42
Avg no of stocks	2437.0	2417.0	2417.0	2417.0
Effective no of stocks	242.0	271.0	242.0	239.0
ATVR (%)	133.52	125.27	132.28	133.48
Gini coefficient	0.62	0.65	0.62	0.62

Source: MSCI. Data from Dec. 30, 1994 to Feb. 28, 2019.

In addition, Exhibit 118 shows the factor attribution for the simulated Emerging Markets indexes. The outperformance of the 10% capped index was mainly due to active country and currency weights, which was in line with the intuition that country capping led to a significant capital reallocation across countries and currencies.

Exhibit 118: Factor attribution of simulation results

Factor contribution	EM IMI 10% Cap	EM IMI 20% Cap	EM IMI 30% Cap
Active return	0.89	-0.08	-0.12
Currency	0.13	0.02	-0.01
Countries	0.49	0.01	-0.04
Industries	-0.03	0.02	0.04
Value	0.05	0.01	0.01
Size	0.03	0.0	0.0
Momentum	-0.05	-0.03	0.0
Quality	0.0	0.0	0.0
Yield	0.0	0.01	0.01
Volatility	0.21	0.02	0.01
Growth	-0.01	0.0	0.0
Liquidity	0.01	0.0	0.0
Asset selection	0.07	-0.14	-0.13

Source: MSCI. Data from Dec. 30, 1994 to Feb. 28, 2019.

The actual impact of the capping methodology is also shown in the active weights in Exhibit 119: The 10% and 20% caps led to an underweight in China. The 10% cap additionally underweighted Korea and Taiwan. It is interesting to note that as of 28 February 2019, the 30% capping methodology had no impact, since China's weight had naturally fallen below the 30% cap level.

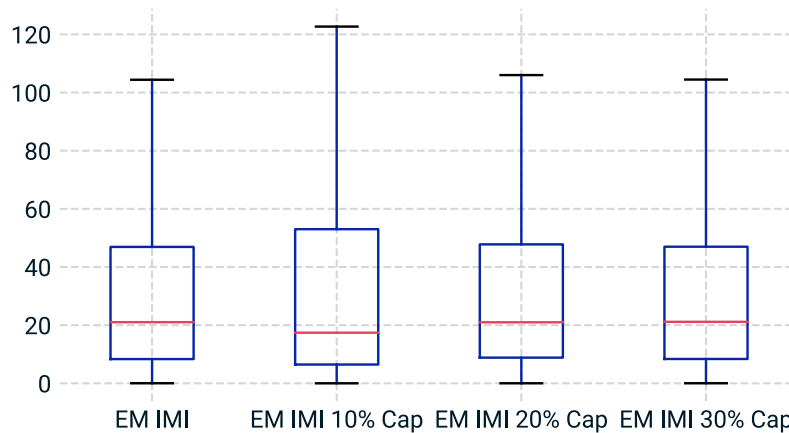
Exhibit 119: Active country weights in simulation results

Country	EM IMI 10% Cap	EM IMI 20% Cap	EM IMI 30% Cap
China	-156.6	-79.5	0.0
Korea	-41.0	16.3	0.0
Taiwan	-19.9	14.2	0.0
Pakistan	1.0	0.2	0.0
Czech Republic	1.2	0.2	0.0
Thailand	19.4	3.0	0.0
Mexico	21.7	3.3	0.0
Russia	25.2	3.9	0.0
South Africa	27.7	6.0	0.0
Brazil	28.8	7.9	0.0

Source: MSCI. Data as of Feb. 28, 2019.

In addition, Exhibit 120 compares the days to trade of the simulated indexes as a measure for index replicability. While the 20% cap and 30% cap version were very similar in their replicability profile, the 10% capped version showed an increase in the number of days to trade the index portfolio, which means that the capping of large country exposures redistributed index weights toward some less liquid securities.

Exhibit 120: Days to trade USD 100 bn³⁵



Source: MSCI. Data as of Feb. 28, 2019.

Summary of key observations

- Comparing EM benchmarks targeting 90%, 95%, 98% and 99% market coverage to MSCI IMI Emerging Markets, we observed slightly higher historical returns for broader market coverage levels. We did not observe a significant liquidity premium for small caps.
- We assessed different versions of simplified Emerging Markets benchmarks by removing countries with high levels of market governance risk. Historically, there was a slight reduction in performance and increase in risk from removing countries, in line with our finding in section three of this report that country governance risk, as well as market size and market liquidity, showed a risk premium.
- Overall, in our study period there was a trade-off between the objective to create a more narrowly defined Emerging Markets benchmark on the one hand and financial performance on the other.
- Our analysis of capping country weights within Emerging Markets showed that the application of 20% and 30% caps had a fairly small impact on risk and performance. However, the application of a 10% cap led to a clear reduction in risk but also higher tracking error and higher turnover.

³⁵ The plot shows average number of trading days needed (red line) and the interquartile range (IQR) defined as the range Q3-Q1 between the 25th percentile Q1 and 75th percentile Q3 (blue box) as well the winsorized minimum and maximum range from $Q1 - 1.5 * IQR$ to $Q3 + 1.5 * IQR$ (black lines).

7. Other dimensions of risk and return

In this section, we explore additional sources of risk and return that go beyond the standard risk measures used in previous sections. To start with, we look at the size premium in global markets, and assess how far benchmarks targeting different levels of market coverage may capture the size premium.

In addition, we assess sector risks in global equity markets and asymmetries in global equity returns.

Global size premium

In this section, we simulate different versions of the MSCI ACWI IMI by reducing the target market capitalization coverage to see how far narrower benchmarks can still be representative of the underlying equity market and capture the size premium of small caps.

A key element in defining an asset owner's opportunity set and the related policy benchmark is the market capitalization coverage, because of the inherent trade-off between accessing a broad investment opportunity set on the one hand and trading costs for an index on the other. While MSCI ACWI IMI targets a 99% coverage level, other coverage levels may be employed by asset owners seeking a slightly narrower opportunity set, with less exposure to small caps.

To assess this trade-off in further detail, we compared the following versions of a global benchmark:³⁶

- MSCI ACWI, which is a well-recognized global benchmark of large and mid caps, targeting 85% of the market capitalization coverage of Developed and Emerging Markets, but with no coverage of small caps.
- A simulated version of MSCI ACWI IMI with a market coverage level of 90%.
- A simulated version of MSCI ACWI IMI with a market coverage level of 95%.
- A simulated version of MSCI ACWI IMI with a market coverage level of 97%.
- A simulated version of MSCI ACWI IMI with a market coverage level of 98%.
- MSCI ACWI IMI, which targets a market coverage level of 99%.

³⁶ The simulated benchmarks covering 95% and 98% of the market were carved out from the ACWI IMI index and may differ from benchmarks that are simulated using a bottom up historical re-balancing. However, we expect these carve-outs to be a good proxy for fully simulated benchmarks.

Exhibit 121 compares these different opportunity sets. By far the most obvious difference was in the number of securities, with each percentage point reduction in market coverage reducing the opportunity set in small caps. In parallel, concentration risk increased with the reduction in small caps as measured by the effective number of stocks and these indexes' Gini coefficients. Differences in index liquidity were quite small.

From a performance perspective, MSCI ACWI IMI outperformed the MSCI ACWI Index by 18bps annually over the study period with slightly higher levels of volatility, showing the financial benefit of adding small-cap exposure to a global benchmark. Interestingly, the benchmarks with a 90%, 95%, 97% and 98% market coverage level showed very similar outperformance over MSCI ACWI, despite a significant reduction in the number of securities.

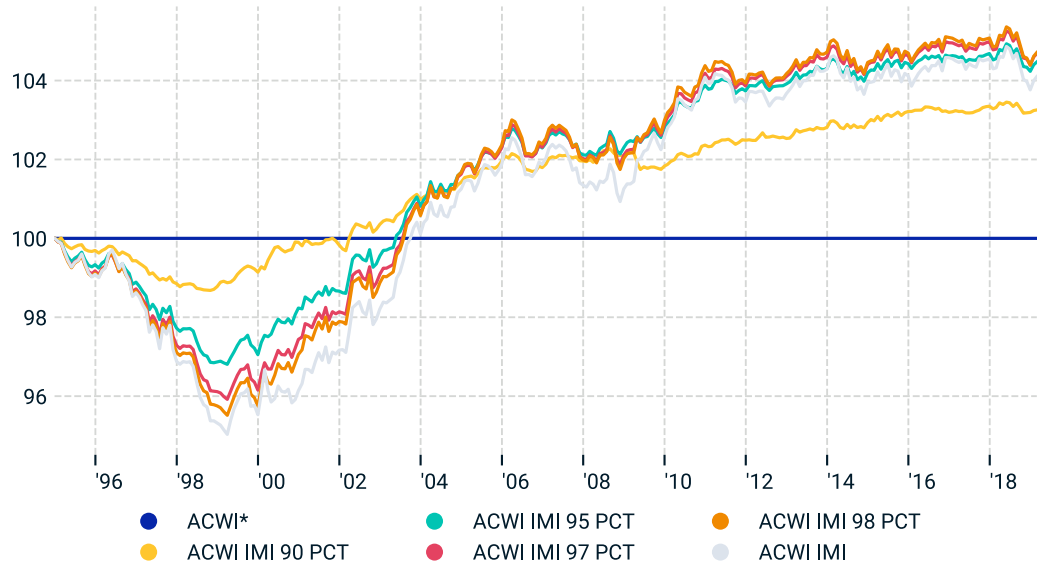
Exhibit 121: Comparison of market coverage levels for global benchmarks

Metrics	ACWI*	ACWI IMI 90 PCT	ACWI IMI 95 PCT	ACWI IMI 97 PCT	ACWI IMI 98 PCT	ACWI IMI
Total return (%)	7.21	7.35	7.4	7.41	7.41	7.39
Total risk (%)	15.09	15.05	15.1	15.13	15.14	15.18
Return/Risk	0.48	0.49	0.49	0.49	0.49	0.49
Tracking error (%)	0.0	0.28	0.5	0.62	0.68	0.78
Avg no of stocks	2611.0	3505.0	5343.0	6681.0	7683.0	9454.0
Effective no of stocks	439.0	479.0	533.0	555.0	566.0	581.0
ATVR (%)	108.59	109.9	112.02	112.65	112.86	113.04
Gini coefficient	0.61	0.59	0.61	0.62	0.63	0.66

Source: MSCI. Data from Dec. 30, 1994 to Feb. 28, 2019. *GIMI methodology applied prior to June 2008.

In addition, the tracking errors to MSCI ACWI increased with the coverage of small caps. Notably, in our study period from 1994 to 2019, the benchmarks including small caps saw a period of underperformance at the beginning due to the Asian crisis in 1997 and 1998 and the boom of technology stocks in the U.S., which explained the overall relatively weak outperformance over MSCI ACWI during the entire study period. However, for the 20-year period ending 28 Feb., 2019 (which excludes the Asian crisis) the outperformance of MSCI ACWI IMI over ACWI was 49bps annually, and even the version covering 95% of the market still showed 44bps p.a. outperformance.

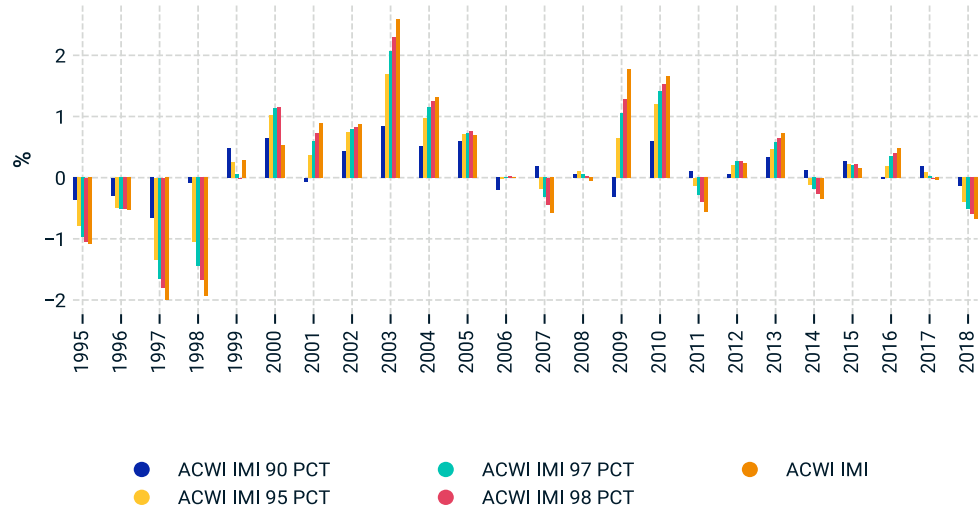
Exhibit 122: Relative performance comparison of global benchmarks to MSCI ACWI



Source: MSCI. Data from Dec. 30, 1994 to Feb. 28, 2019. *GIMI methodology applied prior to June 2008.

Exhibit 121 and Exhibit 122 show the historical outperformance of global benchmarks that include small caps with market coverage levels of 90%, 95%, 97%, 98% and 99% compared to MSCI ACWI, the latter only including large caps and mid caps (85% market coverage target). To better understand variations and cyclical behavior in the size premium between these different coverage levels, Exhibit 123 shows the history of yearly active returns of these simulations versus MSCI ACWI. We observe that all market coverage levels showed similar levels of outperformance over MSCI ACWI and similar cyclical behavior: Size premia were negative in times of falling equity markets, such as the Asian crisis of 1997 and 1998, and during the financial crisis in 2007.

Exhibit 123: Active returns at different market cap coverage levels



Source: MSCI. Data from Dec. 30, 1994 to Feb. 28, 2019. *GIMI methodology applied prior to June 2008.

Next, we examine regional differences in the size premium and performance differences among small caps. Exhibit 124 compares the performance of each regional benchmark including small caps to the benchmark that excludes them. The performance contribution from the size factor was positive and relatively similar in all regions during the study period.

Overall, regional benchmarks containing small caps outperformed their respective regional benchmarks in Developed Markets and Emerging Markets, with very similar levels of size premium.

Exhibit 124: Active return contributions of ACWI IMI and sub-regions

Region	ACWI IMI	North America IMI	Europe IMI	Pacific IMI	EM IMI
Active return	0.18	0.13	0.23	0.07	0.23
Currency	-0.03	-0.01	-0.05	-0.06	-0.08
Countries	-0.02	0.0	0.02	-0.15	-0.05
Industries	-0.02	-0.01	-0.05	0.0	-0.11
Value	0.1	0.08	0.06	0.17	0.31
Size	0.1	0.09	0.08	0.11	0.11
Momentum	0.05	0.04	0.1	-0.05	0.04
Quality	-0.06	-0.11	0.0	-0.02	-0.07
Yield	-0.02	-0.03	-0.02	0.01	0.0
Volatility	0.04	0.1	0.01	-0.04	0.05
Growth	0.01	0.02	0.01	0.0	-0.02
Liquidity	-0.02	-0.03	0.0	0.0	-0.02
Asset selection	0.06	-0.02	0.06	0.1	0.07

Source: MSCI. Data From Dec. 30, 1994 to Feb. 28, 2019. *GIMI Methodology applied prior to June 2008.

To probe deeper into the contribution of small caps to the outperformance, we split all small caps in MSCI ACWI IMI into five quintiles by size, with the largest in Q1 and the smallest in Q5. The corresponding market coverage levels of the small cap universe are shown in Exhibit 125.

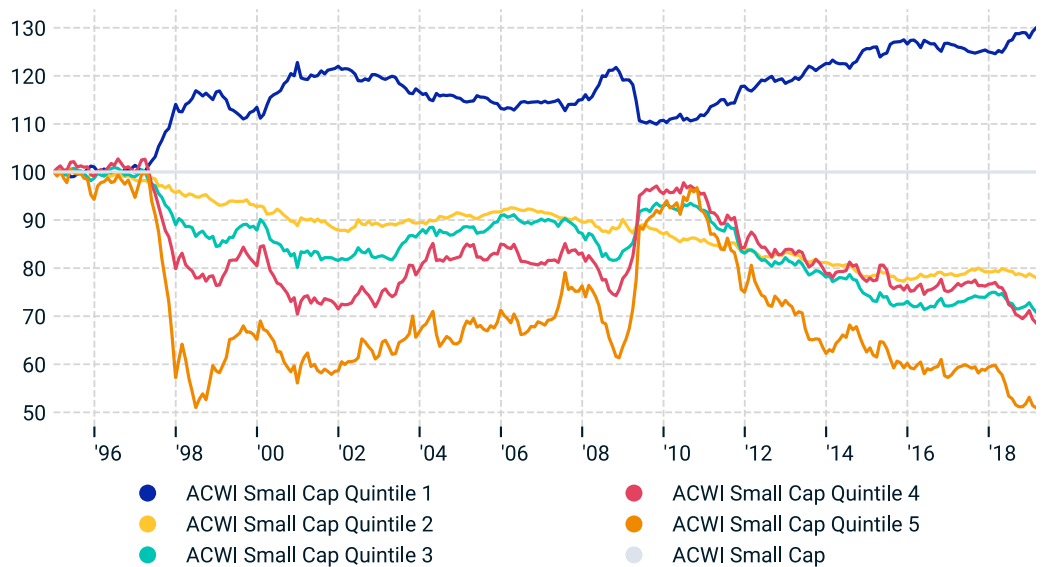
Exhibit 125: Small cap coverage of quintiles

ACWI Small Cap	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5
Parent coverage (%)	55.9	21.6	11.9	6.9	3.7

Source: MSCI. Data as of Feb. 28, 2019.

To understand potential differences in the size premium among small caps, Exhibit 126 compares the performance of these quintiles to the total universe of small caps (i.e., the MSCI ACWI Small Cap Index) and provides a return contribution analysis. Interestingly, the first size quintile containing the largest small caps outperformed all other size quintiles during the study period.

Exhibit 126: Active return contributions of size quintiles within the MSCI ACWI Small Cap Index



Source: MSCI. Data From Dec. 30, 1994 to Feb. 28, 2019.

To summarize, during the past two decades we found a positive size premium within MSCI ACWI IMI, which was quite uniform across regions but strongest for the largest size quintile of small-cap companies.

Sector risk in global equity markets

In previous sections we focused on understanding country risks and diversification benefits across regions and countries. However, another important aspect of risk diversification is sector or industry risk. Like countries, sectors may follow different cyclical paths and therefore diversifying sector risks is an important aspect of global asset allocation.

Exhibit 127 shows the historical risk and performance profile of MSCI ACWI GICS sectors, clearly illustrating the different cyclical behavior of sectors. For instance, over the five years ending Feb. 28, 2019, Information Technology outperformed all other sectors. However, over the full study period, Information Technology also showed the largest historical drawdowns at the end of the dot-com bubble. By contrast, Consumer Staples and Healthcare were the least cyclical sectors, with relatively stable performance and clearly lower levels of drawdown risk than all other sectors, reflecting that these sectors service basic needs which continue through all phases of the business cycle.

Exhibit 127: ACWI sectors risk and performance overview

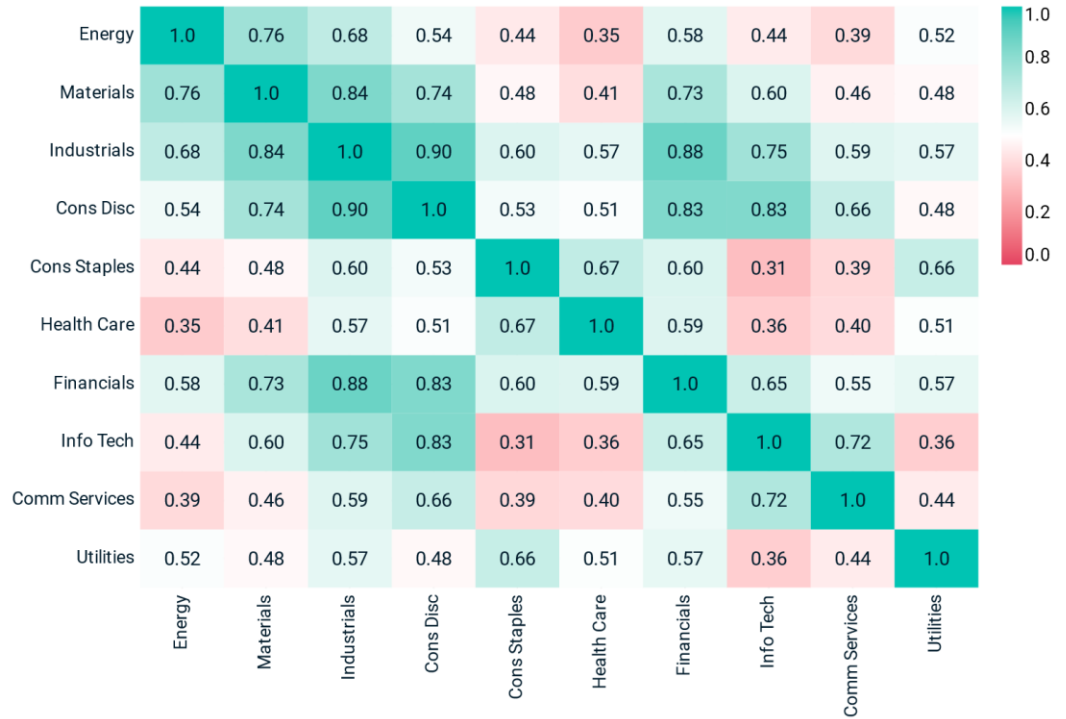
Index	Energy	Materials	Industrials	Cons Disc	Cons Stap	Health Care	Financials	Info Tech	Comm Services	Utilities	Real Estate
Full period return (%)	6.99	7.61	6.75	6.37	6.84	6.67	3.97	5.77	2.15	5.54	5.39
5 Yr (%)	-1.14	2.98	6.55	7.65	5.93	7.86	5.76	15.25	2.5	6.36	
10 Yr (%)	6.16	9.42	14.63	17.39	12.62	15.06	13.49	18.99	8.8	7.85	
Sharpe ratio	0.24	0.26	0.27	0.25	0.42	0.36	0.1	0.15	0.0	0.27	0.35
Volatility PA	13.05	14.42	11.97	11.48	7.75	8.53	13.69	16.44	12.21	9.02	7.08
VaR @ 99%	-13.73	-18.48	-13.56	-11.69	-7.56	-8.31	-15.98	-18.44	-14.93	-11.35	-6.76
CVaR @ 99%	-17.97	-25.97	-19.09	-16.58	-10.42	-11.2	-21.64	-22.37	-15.46	-13.14	-6.76
Max drawdown (%)	58.11	68.24	63.3	59.15	39.54	38.5	75.62	82.14	77.55	47.88	11.81

Source: MSCI. Performance is annualized. Data from Dec. 31, 1998 to Feb. 28, 2018.

These sectoral differences are also evident in the sector correlation matrix, which we show in Exhibit 128, sorted from defensive to cyclical sectors.³⁷ Defensive sectors such as Healthcare or Consumer Staples showed lower levels of correlations to other sectors than cyclical sectors such as Financials or Industrials.

³⁷ See MSCI Cyclical and Defensive Sectors Indexes Methodology, November 2018.

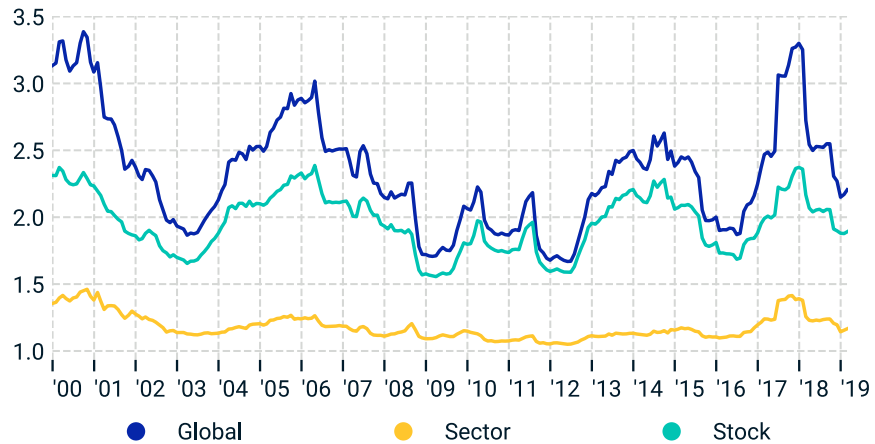
Exhibit 128: ACWI sectors correlation matrix



Source: MSCI. Data from Dec. 31, 1998 to Feb. 28, 2019.

As for our country diversification analysis in sections two and four, the key question is how much diversification benefit was obtained from investing across different sectors. Therefore, Exhibit 129 looks at the diversification ratio discussed in section two, but showing the sector contribution instead of the regional contribution. As for the regional analysis in Exhibit 39, the strongest contribution to diversification was stock diversification.

Exhibit 129: Diversification ratio including sector contribution



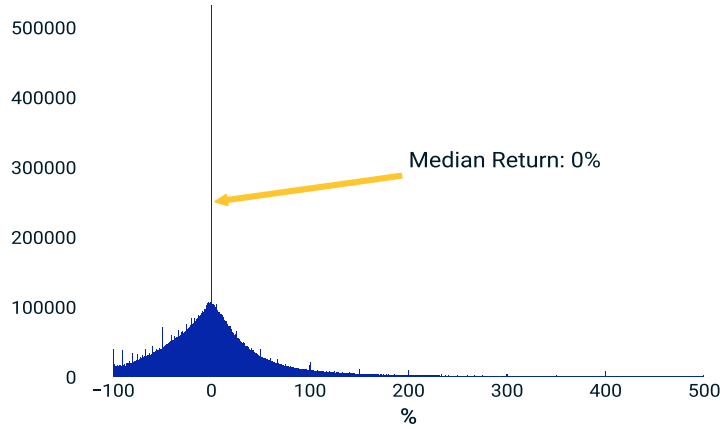
Source: MSCI. Data from Dec. 31, 1999 to Feb. 28, 2019.

Dispersion and skew in global equity returns

Equity returns show dispersion, as we have seen from the analysis of the cross-sectional standard deviation of returns in sections one and three of the report. Bessembinder (2018) looked at annual equity returns in a global database of listed securities and found median equity returns to be below Treasury yields. In addition, he found that the positive equity risk premium of equity benchmarks was due to the skew in equity returns – a relatively few stocks with strong positive performance created an average outperformance over Treasuries (while the median return was found to be below Treasuries).

Exhibit 130 shows a similar analysis, based on annual equity returns in the MSCI Global Equity Database. The results are similar to Bessembinder (2018) in that the median return was found to be close to zero and the distribution of returns was very skewed. However, analogous to this study, we observed many stocks with zero annual returns, indicating that a large number have not been trading.

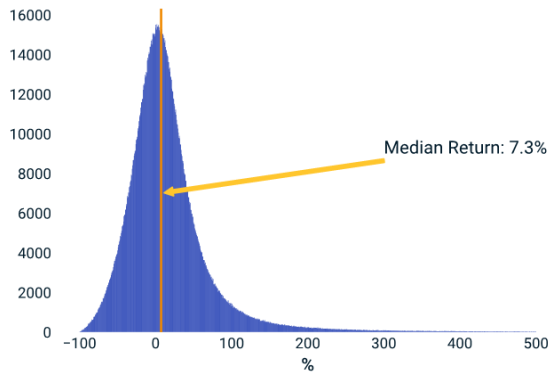
Exhibit 130: Return distribution of all stocks in MSCI Global Equity Database



Source: MSCI. One year returns for all securities in the MSCI database (about 60,000 listed stocks), capped at 500%. Monthly sampling, 1994-2018.

Therefore, we reran the analysis using MSCI ACWI IMI as the universe of stocks, which is filtered for liquidity and size, as shown in Exhibit 131. The results were quite different, with a median stock return of 8.6%. It appears that the large number of illiquid stocks brought the median return in Exhibit 130 close to zero.

Exhibit 131: Return distribution of MSCI ACWI IMI constituents

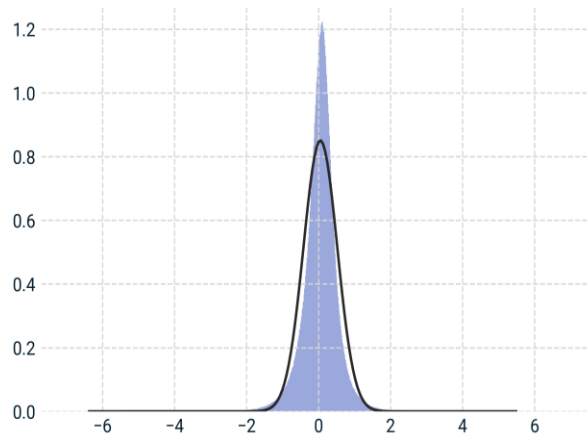


Source: MSCI. One year returns for all MSCI ACWI IMI constituents, capped at 500%. Monthly sampling, 1994-2018.

The second argument of Bessembender (2018) relates to the skew of annual equity returns. Over long periods equity returns move on a logarithmic scale, which is why most financial models assume that they follow a log-normal rather than a normal distribution. To assess whether the logarithmic nature of equity returns may explain the skew of annual returns, we look at log-returns in Exhibit 132: The distribution of

log-returns is almost perfectly symmetrical, with very little skew. This confirms that there is relatively little actual skew in equity returns.

Exhibit 132: Log-return distribution of stocks in MSCI ACWI IMI



Source: MSCI. One-year log returns for all securities in MSCI ACWI IMI. Monthly sampling, 1994-2018

In summary, our results provide a very different view of equity returns than Bessembender (2018): Median equity returns in MSCI ACWI IMI have clearly been positive and above Treasury yields, with relatively little skew.

Summary of key observations

- Comparing benchmarks targeting 90%, 95%, 98% and 99% market coverage to MSCI ACWI (85% target coverage), we observed a positive size premium, which was quite uniform across regions. We did not observe a significant liquidity premium for small caps.
- Our analysis of the MSCI ACWI IMI showed that stock returns were relatively symmetrical (little skew), with a positive mean that was above Treasury yields.

8. MSCI Global Investable Market Index methodology

This section summarizes MSCI’s approach to defining global benchmarks in terms of index design guidelines, index maintenance, index governance, market classification and market consultation on methodology changes. It includes a description of internal committees that govern all index and market classification methodologies. We also provide an overview of how historically changes in the classification of markets have been assessed, prepared for (through market consultation) and implemented. In addition, we show how far free-float adjustments have improved the replicability of indexes.

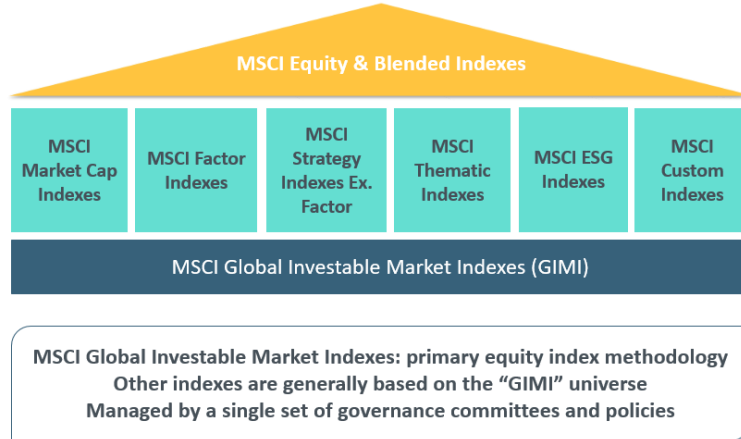
Index design guidelines

MSCI provides a wide variety of indexes, all of which are governed by rules-based methodologies. MSCI’s primary equity index methodology is the MSCI Global Investable Market Index (“GIMI”) methodology. Other equity indexes, including custom indexes created at clients’ request, are in general derived and maintained based on the universe of securities used by the MSCI Global Investable Market Indexes, the MSCI Global Investable Equity Universe.

Groupings of MSCI equity indexes include regional and individual country indexes and related size and sector indexes, which are based on the GIMI methodology (Exhibit 133). These indexes serve as the “parent” indexes for other MSCI indexes created according to methodologies designed to represent the performance of specific investment themes and strategies, such as MSCI Factor Indexes, MSCI ESG Indexes, MSCI Thematic Indexes and MSCI Strategy Indexes.

While different MSCI indexes, including custom indexes, address specific investment themes and strategies, they are all managed by a single set of governance committees, procedures and policies, which are described in this section.

Exhibit 133: MSCI equity index structure



Source: MSCI

MSCI publishes methodology documents governing its indexes, outlining index objectives and explaining the rules and guidelines followed by MSCI to create and maintain the indexes in the widest set of possible circumstances. MSCI’s rules-based index methodologies are designed to ensure that indexes are constructed with integrity and that discretion is not used in their production, except in unusual cases not effectively addressed by the methodology. In those instances, MSCI has a process for escalation and approval, and in certain cases, consultation.

MSCI indexes aim to accurately and objectively measure the performance of a market’s investment opportunity set, a market segment, a theme or an investment strategy.

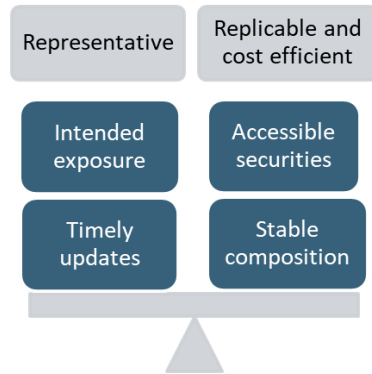
MSCI indexes are constructed and maintained with the following primary objectives in mind:

- **Representativeness:** does the index reflect the appropriate opportunity set?
- **Replicability:** can the index composition be timely reflected in a portfolio?
- **Efficiency:** does replication of an index create unnecessary turnover and trading costs?

Index methodologies aim to find the right balance between the representativeness of the underlying market or strategy on the one hand and the replicability of the index in an actual portfolio in a cost-efficient manner on the other hand (Exhibit 134).

Therefore, in addition to selecting the right economic exposure, it is equally important to assess securities’ other characteristics, such as size, liquidity, free-float and restrictions to international institutional investors.

Exhibit 134: Striking the balance between representation, replicability and efficiency



Source: MSCI

The rationale for adopting each specific methodology is based on a thorough review against the market and the economic reality the indexes are intended to represent. For new index methodologies, this review typically includes backtesting as appropriate.

For custom indexes, the objective of the index is determined in close cooperation with the client and the client-defined methodology is documented in the custom index methodology documents as agreed with the client or as required.

Index and methodology review process

Once constructed, all MSCI indexes are rebalanced regularly and methodologies governing indexes are reviewed at least annually, usually at the same time as the index rebalancing process.

As part of the regular index rebalancing process, MSCI indexes are reviewed relative to the market or strategy they are designed to reflect. This assists in the evaluation of methodologies for both consistency and effectiveness and may lead to changes in the methodology to reflect changes in the underlying market opportunity set. Proposed changes are presented to the Equity Index Committee (“EIC”) and will trigger a consultation if they are material.

The index rebalancing frequency is typically quarterly or semi-annually, but can be daily, monthly, annual or triggered by conditions specified in the relevant methodology. Timely and consistent treatment of corporate events also occurs outside regular rebalancings.

All index methodologies are formally reviewed at least annually, typically by analyzing a representative set of indexes, to ensure the methodology continues to reflect its stated objective and complies with the current MSCI Index Policies document. Some methodologies, such as the MSCI Global Investable Market Indexes Methodology, are reviewed quarterly, coinciding with each index rebalancing. In addition, all new methodologies are reviewed and approved by the EIC and all rebalancing tools are thoroughly tested.

MSCI may trigger out-of-cycle methodology reviews based on, but not limited to, one of the following:

- Market participant feedback
- Underlying market review and rebalancing
- Unusual corporate events and other constituent data changes
- Current events and news

Index changes resulting from index rebalancing or methodology reviews are announced to all market participants in advance of implementation.

In cases of significant index turnover resulting from methodology changes or market reclassifications, MSCI may consider implementing methodology changes in multiple phases to reduce the potential market impact and ensure the replicability of the index during the transition period.

Some examples of such phased implementations are the two-step transition to the MSCI Global Investable Market Indexes methodology in 2007 and 2008, and the multi-step partial inclusion of China A shares in the MSCI China Indexes in 2018.

Index governance

MSCI is committed to high standards of benchmark administration. Over the years, MSCI has developed an independent, robust, efficient and transparent index governance framework, whose key principles are summarized in Exhibit 135.

Exhibit 135: Key index governance principles



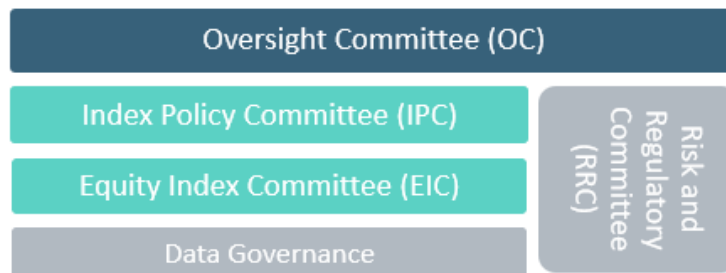
Source: MSCI

More recently, index governance and oversight have been further enhanced through MSCI’s adoption of the IOSCO Principles for Financial Benchmarks and compliance with the EU benchmark regulation (“BMR”) requirements.

A key element of MSCI’s index governance framework is the use of committees, which aims to ensure that decisions are not made unilaterally and index methodology decisions are made consistently in accordance with the published rules-based methodologies and index policies. The committee structure summarized in Exhibit 136 ensures efficiency and accountability.

Exhibit 136: MSCI index governance committee structure

MSCI Index Oversight and Governance



Source: MSCI

All MSCI committees are staffed solely by MSCI group company employees with extensive relevant experience. MSCI believes that its editorial and operational independence is critical to ensure objectivity and efficiency, and to avoid conflicts of interest. In addition, all MSCI employees who are part of the decision-making processes or have access to sensitive data are behind a strict information barrier (“Chinese Wall”).

Governance is provided by the Risk and Regulatory Committee (“RRC”), the Index Policy Committee (“IPC”) and the Equity Index Committee (“EIC”). The RRC presides over operational and business risks and regulatory compliance matters. The IPC and the EIC have independent editorial responsibility over specific index content and methodology decisions. The members of the IPC and EIC are behind the Chinese Wall.

The EIC and IPC are responsible for the approval of content decisions such as changes to methodologies, launch of client consultations and market re-classifications. The IPC presides over major methodology developments and methodology changes as well as market classification decisions. The IPC is an escalation point for the EIC for MSCI equity indexes and the REIC for the MSCI asset-based and fund-based real estate indexes. At the same time, the EIC presides over all the development, review and interpretation of index methodologies.

Governance oversight is provided by the Oversight Committee (“OC”) for all aspects of benchmark administration for MSCI indexes. The OC is independent of the RRC and the index content governance committees (IPC and EIC). The OC has no authority to make specific index content decisions. The members of the OC are also behind the Chinese Wall.

The EIC presides over the development, review and interpretation of index methodologies. The key responsibilities of the EIC include the review and approval of:

- New methodologies, methodology changes and market reclassifications.
- Results of the regular index rebalancings for the Global Investable Market Indexes and several other index methodologies.
- Complex or exceptional corporate event treatment that cannot be addressed by current methodologies.

The EIC is composed of six voting members: the chairman of the IPC and five members with significant experience and seniority selected from MSCI’s Index Research. All members are inside the MSCI Chinese Wall.

The IPC presides over major methodology developments and changes as well as market classification decisions. The IPC is an escalation point for the EIC for the MSCI indexes and the REIC for the MSCI asset-based and fund-based real estate indexes.

The key responsibilities of the IPC include:

- Review and approve new methodologies or methodology changes, as well as consultations, escalated by the EIC for the MSCI indexes and the REIC for the MSCI asset-based and fund-based real estate indexes.
- Make final decisions on market reclassifications for the MSCI equity indexes.
- Review summary of regular equity index rebalancing results for the MSCI Global Investable Market Indexes.

Consultation policy

When MSCI considers a material change in its index methodology, it seeks to understand the potentially differing views in the investment community through its broad consultation process. After considering the feedback from the consultation process, the decision making remains the responsibility of MSCI solely, through the Equity Index Committee (“EIC”) and, if necessary, the Index Policy Committee (“IPC”).

Consultation papers and discussions with market participants are often an ideal channel to share the reasoning and the motivation behind MSCI proposals. Structured dialogues enable institutional investors to share their views on existing benchmarks and benchmark practices as well as on potential innovations and required changes. In addition, public consultations give institutional investors lead time to evaluate potential benchmark changes and their implications.

MSCI commences a consultation after the EIC approves a proposal to make a material change to a methodology as recommended by an internal group, e.g., Index Research, Corporate Events or Corporate Data, based on the internal analysis triggered by an internal review or feedback from market participants on a particular topic. Such proposals may generally result from either market related developments or regular methodology reviews.

Once the decision to open a consultation has been taken by the EIC, a consultation document, which describes the consultation topic and, in some cases, presents either the initial thinking on the matter or a “strawman” proposal, is created. This

document is approved by the EIC before public dissemination, including the date by which investors must provide feedback to MSCI.

A consultation begins with an announcement summarizing the MSCI proposal(s) and indicating the location of the consultation document on MSCI's website. The announcement is widely distributed through multiple channels, including the MSCI website, Bloomberg, Reuters and directly to MSCI's clients.

MSCI welcomes feedback from any market participants but will also actively source views from its clients or other specific stakeholders, e.g., stock exchanges, market regulators and other regulatory agencies. It is important for MSCI that feedback is obtained from the most appropriate market participants for any consultation topic.

Exhibit 137 shows the types of index users that MSCI may specifically seek feedback from during a consultation. For example, a potential change in market classification of an MSCI Country Index requires information and views about feasibility, impact and design from representatives of all these categories of clients, including small, medium and large benchmark users in each category. Covering all regions is also important in this case as investors from different regions may face different challenges in investing in the assets of the country index in question. A short list of mandatory client feedback is defined by the team leading the consultation and discussed with the relevant MSCI client coverage teams.

Exhibit 137: Sample consultation matrix for a proposed market classification change

Title	Asia	Europe	Americas
Asset Owners	✓	✓	✓
Consultants	✓	✓	✓
Active Asset Managers	✓	✓	✓
Passive Asset Managers	✓	✓	✓
Broker/Dealers	✓	✓	✓

Source: MSCI

Once MSCI has gathered all required feedback, the group in charge of the consultation will analyze the views and formulate an informed recommendation that will be presented to, discussed and debated at the EIC. The EIC will take the final decision on the proposal or escalate to the Index Policy Committee if required. The final decision, while considering all the feedback received, may weigh the feedback of some market participants, e.g., asset owners, asset managers (passive or active), broker/dealers, etc. more heavily, depending on the subject of the consultation.

The final decision, including the rationale that has led to it, is communicated publicly to all market participants at the same time. Most consultation participants request their feedback to remain confidential. MSCI may nevertheless publicly disclose feedback if specifically requested by respective market participants. In that case, the relevant feedback is published together with the final results of the consultation.

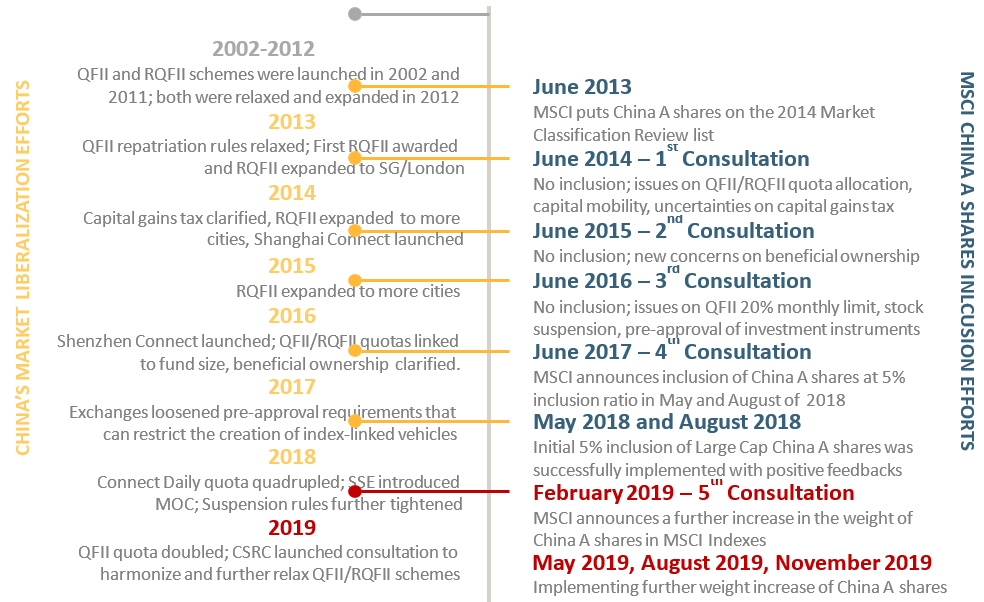
If the final decision is to change the methodology, it will be part of the announcement, including the timeframe for the implementation of the change. Subsequently, MSCI will update the relevant methodology books.

The length of a consultation and lead time provided for the implementation varies depending on the complexity of the topic and breadth of client impact, as well as the impact on the index composition, and is clearly communicated as part of the consultation process. The length of a consultation aims to provide sufficient time for market participants to meaningfully review what is proposed and to respond. For custom indexes, changes to any client specifications are discussed directly with the relevant client.

One of numerous examples of how the consultation process was applied in practice was with respect to the potential inclusion of China A shares in the MSCI China

Indexes and related composite indexes, such as the MSCI EM Index, summarized in Exhibit 138.

Exhibit 138: China A inclusion journey



Source: MSCI

China A shares were first included on the list for potential inclusion in the MSCI China Indexes as early as 2013, following the relaxation and expansion of the QFII³⁸ and RQFII³⁹ schemes. However, the actual first phase of inclusion only occurred in 2018, after four rounds of broad consultation with market participants. For several years, feedback from international institutional investors highlighted a number of critical issues including QFII/RQFII quota allocation, capital mobility and uncertainties on capital gains tax, among others. Also, for some years, the China A market was known for a very high suspension rate compared to other Emerging Markets.

The decision to include China A shares was made following broad support from international institutional investors, which primarily resulted from improvements in the accessibility of the China A market from both the Stock Connect program and the

³⁸ The Qualified Foreign Institutional Investor program (QFII) launched in 2002 had the primary aim to let financial institutions outside China invest in China's stock and bond markets.

³⁹ The Renminbi Qualified Foreign Institutional Investor program (RQFII) was established in 2011.

loosening by the local Chinese stock exchanges of pre-approval requirements that could restrict the creation of index-linked investment vehicles globally. International institutional investors welcomed the expansion of Stock Connect⁴⁰ and viewed it as a more flexible access framework compared to the existing QFII and RQFII regimes. They also welcomed the decrease in the number of suspended China A shares.

Following another, fifth, broad consultation, which was completed in February 2019, MSCI will further increase the weight of China A shares in three phases throughout the remaining part of 2019. This proposal was supported by investors including asset owners, asset managers, broker/dealers and other market participants worldwide.

MSCI will continue to monitor market developments to ensure that the weight of China A shares in the MSCI Indexes remains reflective of the improvement of market accessibility standards.

Construction and maintenance of the MSCI Global Investable Market Indexes

One of the key objectives of the MSCI Global Investable Market Indexes is to provide a very broad coverage of international equity markets while segmenting them into Developed, Emerging and Frontier categories and companies into Large, Mid and Small Cap size-segments. Such segmentation of the equity markets into market and size categories supports investors' strategic asset allocation and risk management process.

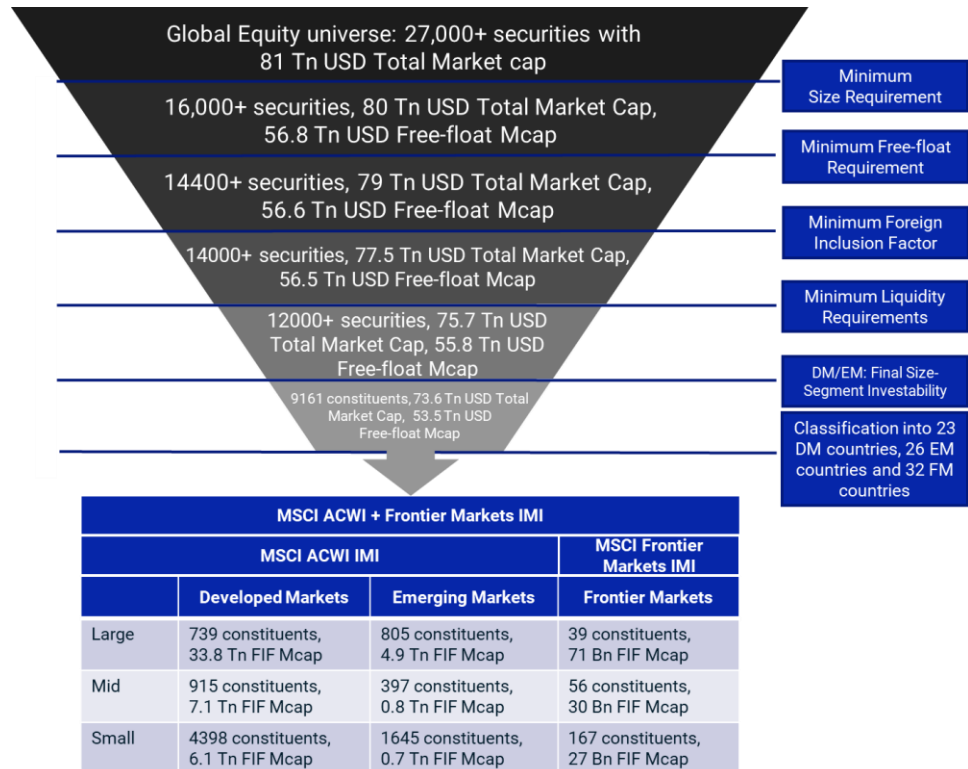
Alongside these objectives, the methodology also aims to select constituents that are investable, as well as providing target index stability. In section seven of this report we saw the advantage of defining the opportunity set of equity markets based on a benchmark such as MSCI ACWI IMI, instead of simply using the universe of all listed securities. Index stability is also crucial to make implementation more efficient and alleviate the need for excessive trading.

To achieve these objectives, as shown Exhibit 139, MSCI first applies filters on the basis of minimum size, liquidity, free-float and foreign ownership limits, which aim to enhance the replicability of the benchmark, followed by a globally consistent size segmentation process. Markets included in the Global Equity Universe are allocated into Developed, Emerging and Frontier Market categories, and each company is

⁴⁰ The Shanghai-Hong Kong Stock Connect program launched in 2014 is a cross-boundary investment channel that connects the Shanghai Stock Exchange and the Hong Kong Stock Exchange. In addition, the Hong Kong-Shenzhen connect was launched in Dec 2016, which completed the Hong-Kong mainland connect programs.

attributed to one country, setting the basis for a building block approach for the construction of the global indexes.

Exhibit 139: From the Global Equity Universe to the MSCI Global Investable Market Indexes



Source: MSCI. As of 17 April 2019 (the price cutoff date of the semi-annual index review as defined in the MSCI Global Investable Market Indexes Methodology).

The construction and maintenance of the MSCI Global Investable Market Indexes follows the guiding principles outlined above, with detailed rules described in the MSCI Global Investable Markets Indexes Methodology (April 2019). Exhibit 140 summarizes the key steps in constructing the MSCI Global Investable Market Indexes. This process is described in further detail in the following sections.

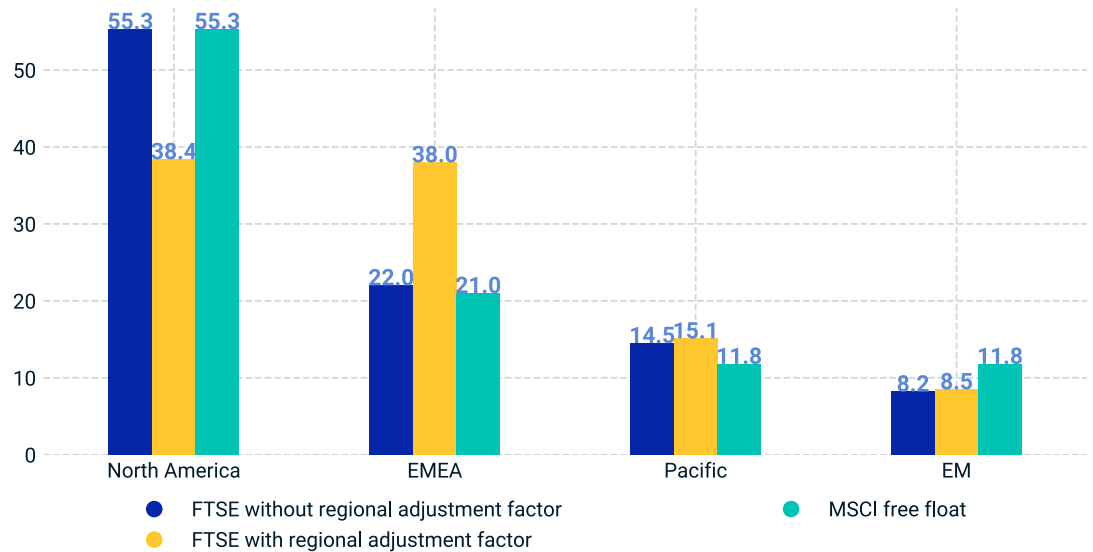
Exhibit 140: Key index construction steps



Source: MSCI.

While the general objectives for the construction of market-cap weighted indexes are similar across index providers, the approach taken to implement these objectives may vary, resulting in differences in index composition. For example, Exhibit 141 provides a comparison of regional weights within MSCI ACWI IMI versus weights in the GPF’s current benchmark, which uses FTSE’s index methodology. Overall, the differences in regional weights were small. However, MSCI’s benchmarks did show a slightly higher weight in EM and a lower weight in the Pacific region, because MSCI has classified South Korea as Emerging Markets, whereas FTSE classifies it as Developed Markets.

Exhibit 141: Comparison of regional weights within MSCI ACWI IMI versus GPFG's current benchmark



Source: MSCI, Norges Bank and the Ministry of Finance. Data as of Dec. 29, 2017.

Index providers may also use different approaches for measuring trading liquidity, size segmentation or specific restrictions such as free-float or foreign ownership limits.

In addition, we have also simulated MSCI ACWI IMI using the same regional scaling factors that GPFG⁴¹ applies to the FTSE benchmark, i.e.,

- a) Developed European markets excluding Norway: 2.5
- b) USA and Canada: 1.0
- c) Other Developed markets: 1.5
- d) Emerging markets: 1.5

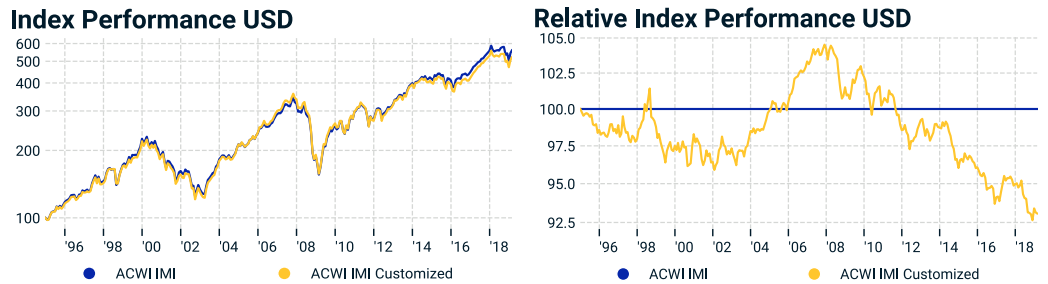
The performance difference between the benchmark using this customized weighting scheme and MSCI ACWI IMI, as shown in Exhibit 142, can be explained by the relative overweight in Europe and Emerging Markets, which caused

⁴¹

https://www.regjeringen.no/contentassets/9d68c55c272c41e99f0bf45d24397d8c/gpfg_mandate_14.05.2018.pdf

outperformance from 2002 to 2008, and the underweight in North America, which caused underperformance since 2008.

Exhibit 142: Performance of MSCI ACWI IMI vs ACWI IMI with customized weights



Source: MSCI. Data from Dec. 30, 1994 to Feb. 28, 2019.

Exhibit 143 shows a comparison of index characteristics. The customized benchmark version showed similar levels of diversification, as measured by the effective number of stocks and the portfolio Gini coefficient, and also had a similar level of index liquidity. The customized benchmark showed a slightly higher level of volatility due to the relative underweight in North America.

Exhibit 143: Performance comparison

Metrics	ACWI IMI	ACWI IMI Customized
Total return (%)	7.39	7.07
Total risk (%)	15.18	15.48
Return/Risk	0.49	0.46
Tracking error (%)	0.0	1.59
Turnover (%)	2.96	3.98
Effective no of stocks	581.0	584.0
ATVR (%)	113.04	113.77
Gini coefficient	0.66	0.66

Source: MSCI. Data from Dec. 30, 1994 to Feb. 28, 2019.

The following sections outline the MSCI Global Investable Market Indexes methodology through the lens of the above-mentioned key index construction principles: **representativeness, replicability** and **efficiency**.

Representativeness of the MSCI Global Investable Market Indexes

Over the years, MSCI has continuously increased the coverage of the MSCI Global Investable Market Indexes, in terms of both breadth and depth. MSCI introduced the MSCI Emerging Markets indexes in 1998 and the MSCI Frontier Market indexes in 2007.

MSCI also increased market coverage of smaller companies by introducing the Small Cap size segment in 1998 and the Micro Cap size segment in 2010. In addition, starting from 2015, several sizable companies, listed and typically incorporated in foreign countries, became eligible for inclusion in the indexes. This impacted several Emerging Markets, particularly China, where companies such as Alibaba and Baidu were added.

Exhibit 144: Historical development of market benchmarks



(1) Small Cap indexes launched in: 1998 (Developed Markets), 2007 (Emerging Markets), 2010 (Frontier Markets)
 (2) Currently available for Developed Markets only

Source: MSCI

Another critical enhancement to the MSCI Equity Index construction methodology was made in 2007, when MSCI introduced the concept of size and coverage integrity across markets. Indexes are often constructed only based on a market coverage percentile approach. While this can be acceptable for individual market benchmarks, it may create significant inconsistencies across markets when comparing the size of companies from different countries allocated to the same size segment.

When constructing and maintaining the MSCI Global Investable Market Indexes, MSCI balances between the appropriate representation of each market and providing size consistency across markets. For example, the coverage of the Standard Size-

Segment (Large Cap + Mid Cap) can range between 80% and 90% of the investable equity universe, while also simultaneously being in the pre-defined global size range. The size segment market cap cutoffs are reviewed appropriately to keep the markets in compliance with size and coverage targets.

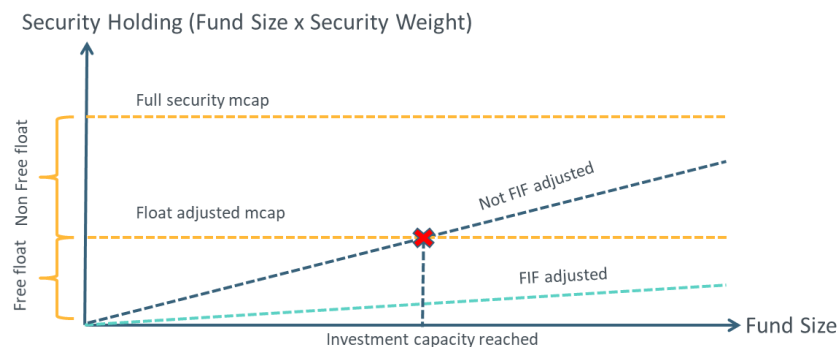
Replicability of the MSCI Global Investable Market Indexes

To enhance replicability of the MSCI Global Investable Market Indexes, MSCI applies several screens on company size, free-float, foreign ownership restrictions and liquidity. The objective is to exclude or reduce the weight of securities that are not easily accessible to international investors.

These requirements evolve over time as the market size and structure change or regulatory changes are observed. For example, the size cutoffs are based on the percentile approach, making them fluctuate with the underlying market. Other requirements, such as foreign ownership limits, may be reviewed as individual companies or countries introduce or relax such limitations.

Measuring and reflecting the free-float available to international institutional investors in the benchmark weighting scheme is critical for making indexes replicable. Including the full company market capitalization in the index may result in capacity issues, particularly for larger investors, and may have a potential market impact at the time of trading. This issue is illustrated in Exhibit 145, which compares the capacity limit for a fund tracking a benchmark with and without the FIF (free-float inclusion factor) adjustment. The use of free-float clearly improves investment capacity.

Exhibit 145: Capacity of free-float versus full market capitalization benchmarks

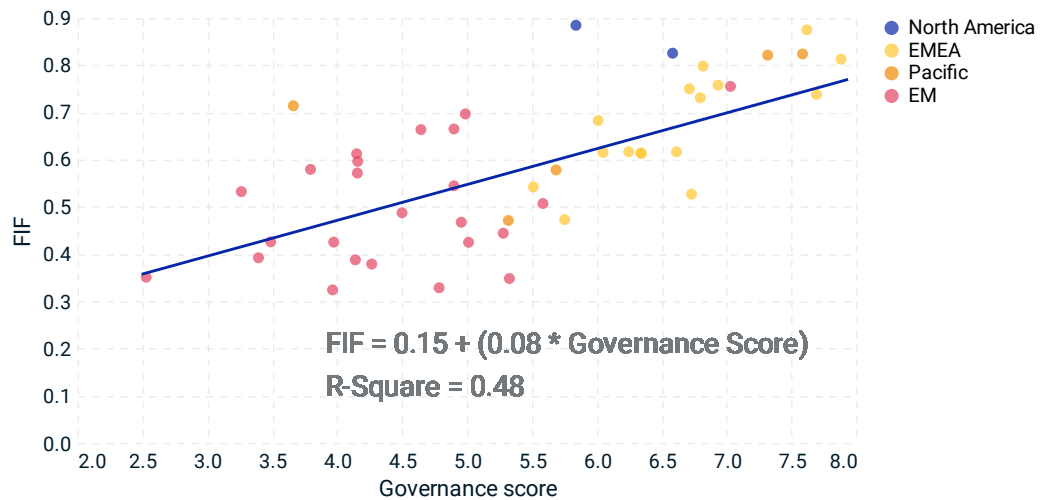


Source: MSCI

Securities with low free-float are generally excluded from the indexes and the market capitalization used to determine the weight of each security is adjusted accordingly.

Another important issue in measuring the free-float of securities is that free-float quotas reflect overall governance standards in a market. For instance, the IMF (2016) observed that markets with lower governance standards displayed higher percentages of closely held shares in listed securities. To address this for MSCI ACWI IMI, we regressed the average free-float quota per country to the average corporate governance score per country (i.e., the 'G' pillar score from MSCI's corporate ESG Ratings). As Exhibit 146 shows, there was a clear positive correlation between a market's average free-float and the level of corporate governance. We also observed higher governance and higher free-float quotas in Developed Markets than in Emerging Markets.

Exhibit 146: Regression of country free-float (FIF) vs average country governance scores

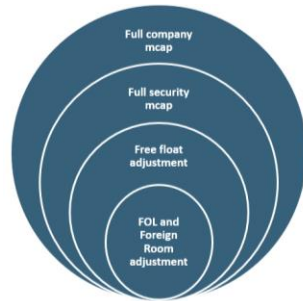


Source: MSCI. Data as of Feb. 28, 2019. MSCI Corporate Governance scores range between 0 and 10.

MSCI defines the free-float of a security as the proportion of tradable shares outstanding that are deemed to be available for purchase in the public equity markets by foreign investors (Exhibit 147) and is determined by:

- Shareholding structure analyzed by a categorization of investor types into non-strategic and strategic.
- Foreign Ownership Limit (FOL), defined as the proportion of a security's share capital that is authorized for purchase by non-domestic investors.
- Foreign Room, defined as the proportion of shares still available for international investors relative to the maximum allowed.

Exhibit 147: Measuring free-float



Source: MSCI

MSCI index methodologies have been updated over time to reflect the evolution of equity markets. Liquidity plays a critical role in how MSCI indexes are constructed and maintained. This is important as the flow of assets into passively managed funds, ETFs and other index-based instruments including derivatives has increased. Because passively managed vehicles need to replicate the linked index, passive managers view it as important for the underlying constituents to be liquid.

To enhance the liquidity characteristics of MSCI indexes, MSCI applies appropriate liquidity filters on all securities considered for index inclusion, as well as assessing market liquidity when classifying markets as Developed, Emerging and Frontier. Changes in liquidity may result in the expansion or contraction of the investable index universe, affecting the number of constituents. At the same time, broad market-level liquidity trends or sudden changes in liquidity due to external factors, such as market interventions, may serve as triggers for market reclassifications.

MSCI index methodologies aim to find the right balance between accurately representing the underlying market and offering the ability to replicate an index in a cost-efficient manner.

While MSCI Global Investable Market Indexes target nearly exhaustive coverage of the equity opportunity set, we use relative volumes (measured by ATVRs) and frequency of trading as measures to ensure the tradability of index constituents. We also monitor suspensions of index constituents – especially around the time of regular index reviews – with the objective of keeping the indexes replicable.

Relative measures of liquidity, such as ATVR, reflect trading volumes relative to the index market capitalization of a security. Using a relative approach is helpful in accounting for the varying size of securities. Also, MSCI balances the sensitivity of the measure to liquidity changes and the stability of index constituents. While index

replicability is important, a well-constructed index also will not generate excessive turnover. Thus, ATVR is constructed as a moving average of each constituent's trading volume, reducing the sensitivity of the measure to elevated volatility.

Using constituents that trade frequently is equally important in index construction. While average volumes for certain securities may be high due to large one-off transactions, it may be difficult to replicate an index consisting of securities that do not trade on certain days. Securities that trade infrequently may therefore be excluded from an index.

MSCI monitors its equity index methodologies on an ongoing basis, with the aim of ensuring that they reflect evolving markets. Changes in market liquidity and structure have led MSCI to enhance its construction methodology in the past decade.

For example, following sharp reductions in liquidity in some markets right after the sub-prime crisis, MSCI decided to complement long-term liquidity measures, such as 12-month ATVR, with the more reactive 3-month ATVR and a 3-month frequency of trading measure.⁴² These enhancements enabled MSCI to more quickly remove securities that suddenly became illiquid from relevant indexes.

The fragmentation of equity markets has led to changes in how MSCI calculates relative trading volume in the MSCI USA and the MSCI Canada equity universes. In 2015, MSCI started using consolidated volumes for calculating relative traded volumes for securities in those markets. MSCI will continue to closely monitor liquidity fragmentation and related regulatory developments in various equity markets. Where appropriate, MSCI may switch to consolidated volumes for securities classified in other markets. For example, MSCI is monitoring the adoption of MiFID II in Europe, which was effective January 2018, to see how it affects the current lack of transparency in trade reporting.

Given the discrepancy between liquidity levels in Developed and Emerging Markets, MSCI uses more stringent liquidity requirements for Developed Markets. MSCI currently deploys higher relative volume thresholds and frequency of trading requirements for these markets. On the other hand, liquidity inclusion requirements do not vary based on market-cap size, as relative traded volumes are generally comparable across size segments.

Equity trading may also be impacted by suspensions, which can be either market-wide or security-specific. Suspensions may result from circuit breakers, company announcements, corporate actions or other events, and may at times become

⁴² Defined as the number of days a security traded within a 3-month period divided by the total number of trading days over that period.

problematic for index replication, especially if they happen around the time of important index changes, such as regular index reviews.

To address this potential replicability issue, in recent years MSCI has enhanced its methodology for the treatment of suspended securities. For example, MSCI has routinely postponed implementing index review changes for constituents when the affected securities were suspended on the day prior to the effective implementation date of the index review. In addition, securities suspended from trading over a significant period of time have generally been removed from indexes.

Efficiency of the MSCI Global Investable Market Indexes

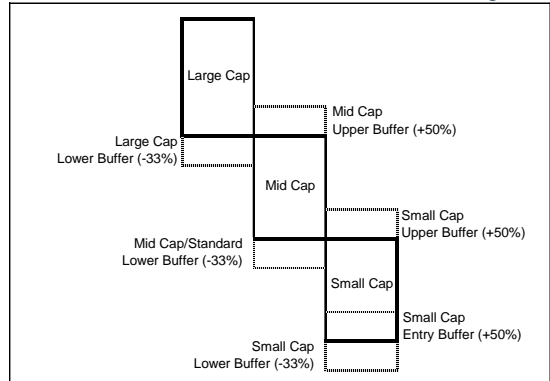
MSCI Equity Indexes are maintained with the objective to be efficient, i.e., to achieve index continuity, stability and low turnover.

To allow for a timely representation of market developments when securities move far away from size-segment thresholds, and to help control index turnover, buffer zones are used to control the migration of companies between size-segment indexes.

An existing constituent is generally allowed to remain in its current size-segment even if its full market capitalization falls below (above) the market size-segment cutoff that defines the lower (upper) boundary of its segment, as long as its full market capitalization falls within a buffer zone below (above) the market size-segment cutoff.

In addition, a small cap entry buffer zone is used for entry in the small-cap indexes of non-current constituents. The inclusion in the small-cap indexes of all newly eligible companies above the investable market size-segment cutoff could lead to an excessively large number of additions of small companies. Consequently, non-current constituents within the small-cap entry buffer zone are included in the small-cap indexes only to the extent that they replace current constituents that have fallen below the small-cap lower buffer.

Exhibit 148: Use of buffers for size segmentation



Source: MSCI

All other thresholds such as those applied for liquidity and free-float adjusted market capitalization also apply buffers with the objective to control index turnover.

Market classification

MSCI classifies markets as Developed, Emerging or Frontier and Standalone. The approach used by MSCI aims to reflect the views and practices of the international investment community by striking a balance between a country’s economic development and the accessibility of its market, while preserving index stability.

Broadly speaking, MSCI calculates individual indexes for each of these markets: MSCI World IMI (Developed Markets), MSCI Emerging Markets IMI and MSCI Frontier Markets IMI. In addition, MSCI ACWI IMI combines Developed Markets and Emerging Markets, and MSCI ACWI + Frontier Markets IMI combines all three markets.

Most asset owners manage their assets in Frontier Markets separately from those in Developed and Emerging Markets, because Frontier Markets lag behind in terms of market accessibility, stability of the institutional framework (which we elaborate below), liquidity and the size of the capital market. The purpose of the MSCI Market Classification Framework is to reflect these differences in a methodological way. Therefore, it incorporates the following three criteria: economic development, size and liquidity, and market accessibility.

To be classified in a given investment universe, a country must meet the three criteria, as described in Exhibit 149.

Exhibit 149: MSCI Market Classification Framework (June 2018)

Criteria	Frontier	Emerging	Developed
A Economic Development			
A.1 Sustainability of economic development	No requirement	No requirement	Country GNI per capita 25% above the World Bank high income threshold* for 3 consecutive years
B Size and Liquidity Requirements			
B.1 Number of companies meeting the following Standard Index criteria Company size (full market cap) ** Security size (float market cap) ** Security liquidity	2 USD 741 mm USD 69 mm 2.5% ATVR	3 USD 1,482 mm USD 741 mm 15% ATVR	5 USD 2,964 mm USD 1,482 mm 20% ATVR
C Market Accessibility Criteria			
C.1 Openness to foreign ownership C.2 Ease of capital inflows / outflows C.3 Efficiency of the operational framework C.4 Competitive landscape C.5 Stability of the institutional framework	At least some At least partial Modest High Modest	Significant Significant Good and tested High Modest	Very high Very high Very high Unrestricted Very high

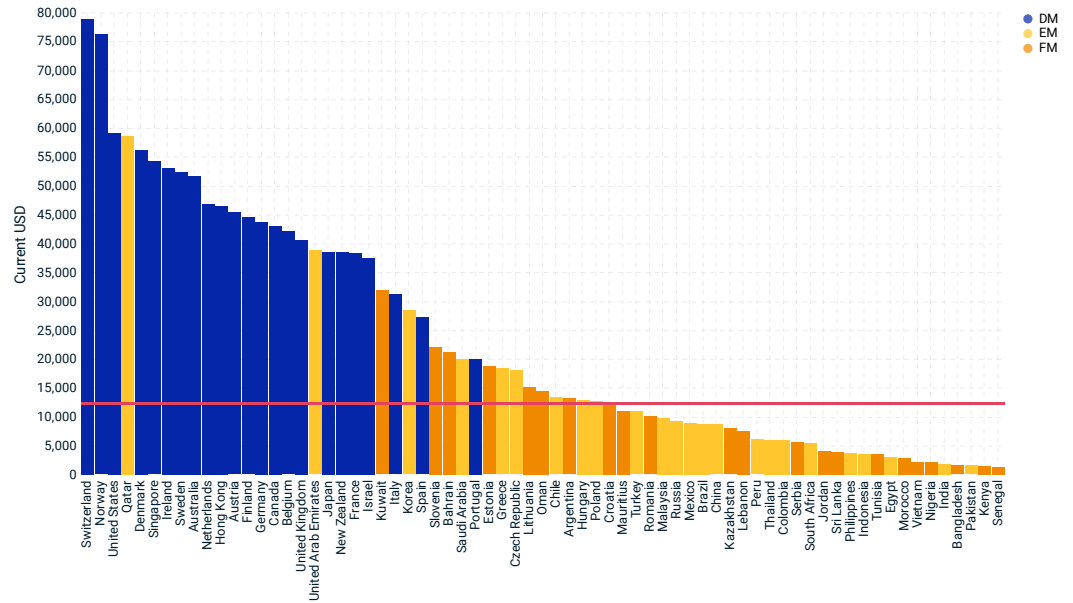
* High income threshold for 2017: GNI per capita of USD 12,235 (World Bank, Atlas method)
 ** Minimum in use for the November 2018 Semi-Annual Index Review, updated on a semi-annual basis

Source: MSCI

The economic development criterion based on countries’ GNI per capita is only used in determining the classification of Developed Markets, and is not relevant for the distinction between Emerging and Frontier Markets. The size and liquidity requirements are based on the minimum investability requirements for the MSCI Global Standard Indexes.

GDP or GNI per capita is one of the most widely used criteria for categorizing markets as “developed” versus “developing” (emerging). Exhibit 150 depicts the investment universe covering countries for which MSCI calculates an index, ranked by GNI per capita. In this group, all markets of countries that have a GNI per capita below the World Bank threshold of a high/middle income country are classified either as Emerging or Frontier Markets. At the same time, some markets are not classified as Developed, despite the countries having sufficiently high GNI per capita. While being “Developed” from an economic perspective, they may lag behind in terms of market accessibility. South Korea, Qatar and UAE are current examples of such cases.

Exhibit 150: MSCI country universe ranked by GNI per capita in USD (2017)



Source: World Bank and MSCI.

To assess the stability of the institutional framework that is part of the market classification methodology MSCI evaluates basic institutional principles such as the rule of law and its enforcement, the stability of the "free-market" economic system and the track record of government intervention with regards to foreign investors.

As of today, no Developed Markets are penalized based on this measure. Further, it was only during limited periods following the European Sovereign Debt Crisis that markets such as Portugal, Italy, Greece or Spain were temporarily downgraded, as the financial and political crisis called into question the stability of the market's institutional framework.

In Emerging and Frontier Markets the situation is generally different. Frequent changes in regulations are more common in these markets and government intervention could be more likely, including more extreme examples of nationalization. For instance, in 2012, Argentina's biggest oil company, YPF, was nationalized through the expropriation of a 51% stake from the Spanish company Repsol. Some other examples of market downgrades were Egypt after the revolution of 2011, resulting in a prolonged equity market shutdown, and Thailand following the military coup in 2014.

It is important to emphasize that each change in the classification of a country is implemented in accordance with the country classification rules outlined above, after a broad market consultation that ensures the change is deemed appropriate by market participants. Exhibit 151 provides an overview of changes implemented in the past decade and the underlying reasons.

Exhibit 151: History of market classification changes over the past decade

Date	Country	Change	Reason
November 2008	Jordan	↓ EM → FM	Most of the constituents of the MSCI Jordan Index no longer met the minimum size and liquidity requirements set for the Emerging Markets indices.
August 2008	Pakistan	↓ EM → FM	Due to the introduction of a “floor rule” at the end of August 2008, which resulted in the practical shutdown of the Pakistani equity market, and the continued lack of visibility regarding a potential re-opening of the market. In addition, the MSCI Pakistan Index no longer met the size requirements set for Emerging Markets. The market was first removed from all composite indexes and classified as a Standalone and then subsequently moved to Frontier Markets.
February 2009	Argentina	↓ EM → FM	Due to the introduction of restrictions on foreign currency trading and the continuous deterioration of foreign exchange market liquidity the market was reclassified to Frontier Markets. In addition, MSCI started using only Depository Receipts for index calculations.
May 2010	Israel	↑ EM → DM	The market met the economic development as well as the size and liquidity criteria under the market classification framework to reach Developed Market status.
November 2013	Greece	↓ DM → EM	Greek market failed to fulfill market size criteria for two consecutive years prior to the reclassification. There was also a long-standing absence of well-established stock lending market and short selling practices as well as other trading and market infrastructure issues.
November 2013	Morocco	↓ EM → FM	Morocco failed the Emerging Markets liquidity criteria for several years prior to the reclassification and the downward trend in liquidity showed no signs of reversal.
May 2014	Qatar	↑ FM → EM	Qatar was upgraded following an increase in Foreign Ownership Limits and improvements in operational efficiency of the DVP model and false trade model of the exchange and increase in foreign ownership limits.
May 2014	UAE	↑ FM → EM	UAE was upgraded following an increase in Foreign Ownership Limits and improvements in operational efficiency of the DVP model and false trade model of the exchange.

May 2017	Pakistan	↑ FM → EM	The market was reclassified following several market infrastructure enhancements as well as prolonged history of normal operation.
May 2018	China A	→ EM	China A shares were partially included following an improved alignment of China with international market accessibility standards.
May 2019	Argentina	↑ FM → EM	The market will be re-included in the MSCI Emerging Markets Indexes following improvements in market accessibility, particularly the removal of capital controls.
May/August 2019	Saudi Arabia	↑ FM → EM	The market will be included following regulatory and operational improvements by the Regulator which effectively increased market opening to international investors as well as improved operational efficiency of the equity market.
May/August/November 2019	China A	→ EM	After further accessibility improvements and reduction of the number of suspensions MSCI will further increase the weight of China A shares in the MSCI Emerging Markets Indexes.

Source: MSCI

The reasons for these reclassifications varied from market to market. Upgrades generally followed an increase in market openness to foreign institutional investors or improvements in market infrastructure, as in the cases of the MSCI Qatar and MSCI UAE Indexes. Such changes usually follow the regular annual cycle, being announced as part of the June Annual Market Classification Review and implemented with one-year lead time as part of the May Semi-Annual Index Reviews.

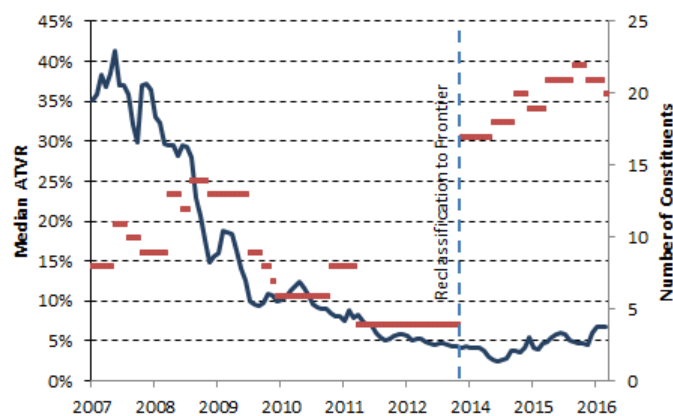
At the same time, downgrades may happen as part of or outside the regular market reclassification cycle and can be caused by a reduction of the market's size, its liquidity, market disruptions or other accessibility issues. For example, the MSCI Greece Index was reclassified from Developed to Emerging Markets in 2013 following a significant fall in the market capitalization of listed companies and subsequently failing the inclusion requirements. While MSCI publicized this change as part of the regular June announcement, the implementation was made as part of the following November Index Review, giving an approximately six-month lead time prior to implementation. This change was implemented to avoid an artificial maintenance of small securities no longer meeting the size requirements for a substantial period.

Liquidity can be another reason for market reclassifications. While some liquidity-induced changes in index composition are normal in any market, some trends or events could lead to a reclassification of the entire country specific market. For example, a prolonged decline in liquidity may result in an extensive reduction in the

number of constituents in a market. In addition, market-wide interventions or suspensions may drastically impact market accessibility.

Morocco provides an example of a market where the number of securities eligible for index inclusion had declined over time, resulting in less liquid indexes (Exhibit 152). This change led to a reclassification of the MSCI Morocco Indexes from Emerging Markets to Frontier Markets in November 2013, as the market fell below the minimum number of eligible constituents.

Exhibit 152: Morocco – liquidity and index constituents

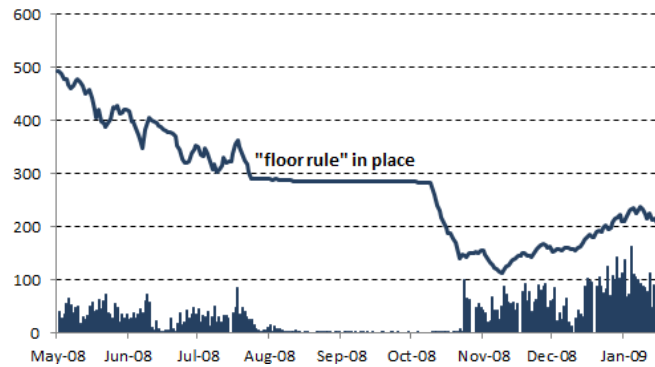


Source: MSCI and Reuters

In some instances, particularly in the case of sudden issues with market accessibility, a sudden drop in liquidity, market disruptions or the introduction of other restrictions such as capital controls, MSCI may consider announcing and reclassifying such markets outside the usual annual cycle.

For example, the MSCI Pakistan Index was removed from the MSCI Emerging Markets Index in December 2008 because of liquidity issues. Unlike Morocco, where the examination of its status was related to a gradual decline in index liquidity, Pakistan’s removal from the index stemmed from the imposition of a so-called “floor rule” during the sub-prime market correction (Exhibit 153). This rule prevented stock prices from dropping below pre-defined levels, practically paralyzing the market for several months. As a result, MSCI reclassified Pakistan. The market returned to Emerging Markets status in June 2017, following continuous improvements in trading conditions and market reforms.

Exhibit 153: Pakistan – introduction of the “Floor Rule”⁴³



Source: MSCI and Reuters

Other examples of market reclassifications due to accessibility issues were the introduction of restrictions in foreign currency trading in Argentina in February 2009, which triggered a downgrade of Argentina from Emerging Markets to Frontier Markets, and the introduction of drastic repatriation restrictions in Malaysia in 1998, when MSCI removed the MSCI Malaysia Indexes from the regional composite indexes.

Some market accessibility issues may not necessarily result in a reclassification, as it is important to strike the right balance between accessibility and index stability. At times, an in-depth analysis of the situation and a market consultation can suggest that a market reclassification may be premature and that a targeted special treatment, or no action at all, is more appropriate. One such example was the introduction of sanctions by the Council of the European Union and the U.S. Department of the Treasury in 2014 on selected entities in connection with events in the Ukraine and Russia. While several index constituents were subject to these sanctions, to avoid unnecessary turnover and market disruptions, MSCI did not change the classification of the MSCI Russia Indexes, while still applying some restrictions on the weight increase for the impacted names. This decision followed a thorough analysis of the sanctions along with a broad market consultation, which revealed no immediate market accessibility concern.

Trading liquidity may also be a reason for preventing some markets being reclassified. Suspensions of constituents within the MSCI ACWI IMI have been

⁴³ Performance of the MSCI Pakistan Index in local currency.

historically rare compared to the total number of constituents, usually ranging between five and ten securities.

In contrast, the number of index constituents suspended within the China A-shares market – which was not included in the MSCI ACWI IMI until May 2018 – was much higher (Exhibit 154): At its July 2015 peak, over 350 constituents of the MSCI China A Index were suspended. Since then the number of suspended China A-shares securities has declined dramatically, bringing China A-shares almost in line with the MSCI ACWI IMI markets. This decrease in the number of suspended securities was one factor contributing to the decision to partially include China A shares into the MSCI ACWI Index.

Exhibit 154: China A – number of constituents with trading suspensions



Based on the full China A shares universe of over 3,000 securities

Source: MSCI

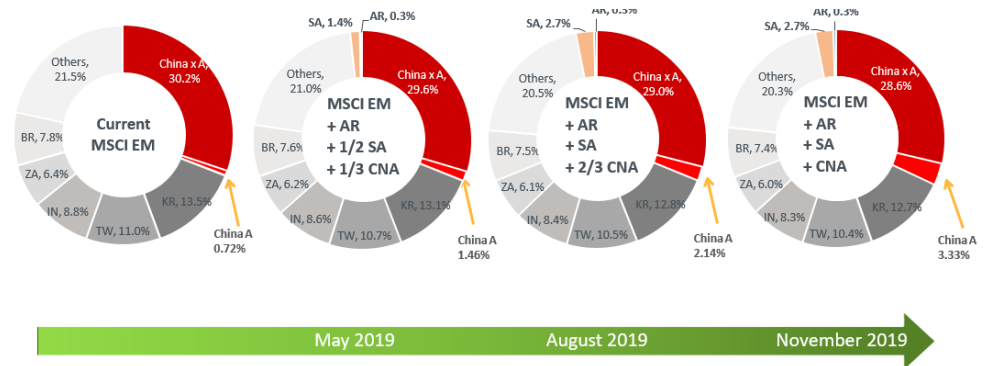
Announced future changes

On June 20, 2018 MSCI announced that the MSCI Argentina and MSCI Saudi Arabia Indexes will be reclassified to Emerging Markets from their previous classifications as Frontier Markets and Standalone Markets, respectively. In addition, on Feb. 28, 2019, MSCI announced that it will increase the weight of China A shares in the MSCI Emerging Markets Indexes. While MSCI will implement the inclusion of the MSCI Argentina Indexes in the MSCI Emerging Markets Index in one step coinciding with the May 2019 Semi-Annual Index Review, the inclusion of the MSCI Saudi Arabia Indexes will be implemented in two equal steps coinciding with the May 2019 Semi-Annual Index Review and August 2019 Quarterly Index Review.

Further increases in the weight of China A shares will take place in three steps, with the last step to be implemented as part of the November 2019 Semi-Annual Index Review, when 20% of China A Large Cap and Mid Cap shares will be included into the

MSCI Emerging Markets Index. Exhibit 155 illustrates the potential impact of these changes on the country weight distribution within the index.

Exhibit 155: Country weights in the MSCI EM Index after the inclusion of Saudi Arabia, Argentina and weight increase of China A shares



Source: MSCI. As of Jan. 22, 2019

Summary of key observations

- MSCI’s global indexes are constructed in a fully rules-based and transparent way following three main objectives: representativeness of the underlying market, replicability of the index and efficiency of the methodology.
- All MSCI indexes are calculated and maintained under MSCI’s strict governance framework: key elements are the use of internal expert committees to assess index reviews and methodology changes and broad market consultations for all methodology changes that can have a material impact on MSCI indexes. All MSCI employees who are part of the decision-making processes or have access to sensitive data are behind the Chinese Wall.
- MSCI’s index methodology framework includes the definition of Developed, Emerging and Frontier and Standalone markets, based on three criteria: economic development of each country, market size and liquidity, and market accessibility. Rule changes and changes to country classifications are implemented after a broad consultation with the market.
- Although there are differences in MSCI index construction rules and country classifications versus GPF’s current benchmark (e.g., MSCI classifies South Korea as Emerging Markets), regional benchmark weights are quite similar.



- The past two decades have seen many instances of country re-classification. Some of these changes reflected long-term changes in market accessibility, whereas others were triggered by an exceptional event in specific markets.
- An important recent market re-classification was the inclusion of China A shares into Emerging Markets, following several rounds of broad market consultation.
- MSCI's coverage of Emerging Markets will continue to grow, with the expansion of China A coverage and the scheduled inclusion of the MSCI Saudi Arabia and MSCI Argentina Indexes into Emerging Markets.

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Appendix

Index data used in the report

The MSCI index methodologies have been constantly modernized to reflect evolutions in the investment process and client needs. Examples relevant to this report include:

- The launch of the MSCI Global Investable Market Index (GIMI) methodology introduced in 2007 and described in detail in section eight of this report. Prior to 2007, large- and mid-cap index segmentations did not exist, and standard indexes were constructed by using a sector sampling methodology at country level. Before 2007 small-cap indexes were calculated for Developed Markets only but were constructed independently of the standard segmentation.
- Daily gross index calculations were introduced in 2002. Prior to that, net and gross index variants were calculated at a monthly frequency only.

For the analysis in this report, we preferred to present results using a consistent and comparable methodology rather than following historical changes. As a result, simulated results were used for MSCI ACWI IMI in section seven when analyzing small-cap impacts on global market returns. Daily price returns were used to calculate volatilities to measure diversification benefits in section two.

Measuring diversification benefits

Following Choueifaty and Coignard (2008) and Coueifaty et al. (2013) we use the so-called diversification ratio to measure the diversification benefit of an equity portfolio. The diversification ratio denotes the relative reduction in volatility due to diversification across securities. In a multi-variate normal distribution model for stock returns with covariance matrix C and the vector of portfolio investments w , the diversification ratio can be expressed as:

$$\text{Diversification ratio} = \frac{\sqrt{w^T \mathbb{I}_C w}}{\sqrt{w^T C w}} \quad (1)$$

Where \mathbb{I}_C denotes the covariance matrix where all correlations are set to 1, which describes a portfolio without any diversification.

However, in a more general framework where equity markets do not necessarily follow a multi-variate normal distribution, we can measure diversification benefits

directly as the relative reduction in volatility due to diversification across securities, countries and regions:

$$\underbrace{\frac{\sum_i Security.Mcap.Vol_i}{ACWI.Mcap.Vol}}_{\text{Global diversification}} = \underbrace{\frac{\sum_r Region.Mcap.Vol_r}{ACWI.Mcap.Vol}}_{\text{Regional diversification}} \times \underbrace{\frac{\sum_c Country.Mcap.Vol_c}{\sum_r Region.Mcap.Vol_r}}_{\text{Country diversification}} \times \underbrace{\frac{\sum_i Security.Mcap.Vol_i}{\sum_c Country.Mcap.Vol_c}}_{\text{Stock diversification}} \quad (2)$$

Summing over the global set of securities $i \in \{ACWI\}$, global sub-regions $r \in \{ACWI \text{ sub-regions}\}$ and countries $c \in \{\text{Countries in ACWI}\}$.

The generalized formula (2) for measuring diversification in terms of volatility or VaR reduction is identical to formula (1) in the case of a multi-variate normal distribution for equity returns.

Fundamental return decomposition

We apply the dividends growth model and the book-on-equity model to decompose equity returns into fundamental drivers (Straehl and Ibbotson, 2016).

Book-on-equity model

The total equity return is broken down into a change in the PE ratio G_{PE} , change in return on equity G_{ROE} , change in book value G_K and dividends. With the book value of equity K and the dividend payout ratio $1-Z$ dividends can be expressed in fundamental terms as $D = K \times ROE \times (1 - Z)$. Analogously, the change in equity price can be expressed as $P_1/P_0 = (1 + G_{PE})(1 + G_{ROE})(1 + G_K)$. In addition, the book value change G_K can be broken down into a real change plus inflation: $1+G_K = (1+g_K)(1+\pi)$.

Consequently, the total return reads:

$$R = \frac{P_1 + D - P_0}{P_0} = (1 + G_{PE}) \times (1 + G_{ROE}) \times (1 + g_K) \times (1 + \pi) - 1 + \frac{D}{P_0}$$

Total Return	Valuation change	Profitability change	Real book value change	Inflation	Dividend yield
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Dividends growth model

The dividends growth model decomposes total equity returns into dividends received by investors (dividend yield), the increase in equity prices explained by real dividend growth plus inflation, and a valuation adjustment denoting all equity price effects not explained by dividends or inflation.

To be precise, the total equity return R consists of a price change from P_0 to P_1 during the observation period and a dividend D_1 paid at the end of the period, which consists of the dividend level D_0 at the beginning of the period and a nominal dividend growth rate $G+\pi$, with G denoting the real growth rate and π the inflation rate. The total return can be decomposed as follows:

$$R = \frac{P_1 + D_0(1 + \pi + G) - P_0}{P_0} = \frac{D_0}{P_0} + G + \frac{D_0}{P_0}G + \pi + \frac{D_0}{P_0}\pi + \frac{P_1 - P_0(1 + G + \pi)}{P_0}$$

Total Return	Dividend yield	Real dividend growth	Inflation	Valuation adjustment
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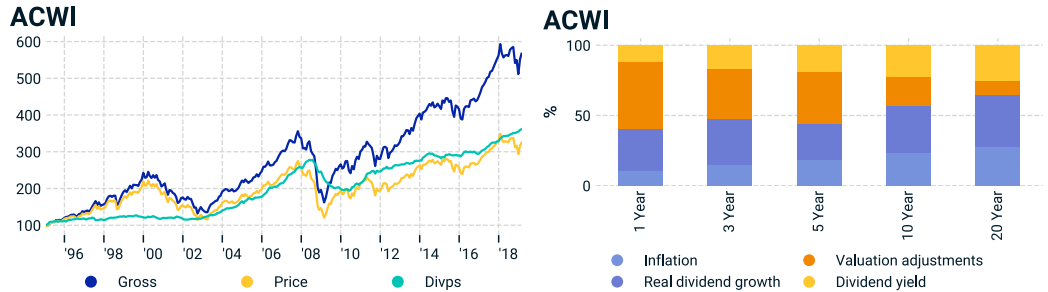
Economically speaking, the valuation adjustment denotes the portion of return not explained by dividends, dividend growth or inflation.

Exhibit 156 shows returns at a global level decomposed into dividend yield, dividend growth and valuation adjustment. Dividend growth is split into real dividend growth and inflation to assess how far notional dividend growth has been driven by price inflation.

We observe that over long periods of time (specifically 20 years) most of the total equity return has been explained by dividends and dividend growth. It is notable that the MSCI ACWI price index has been growing quite closely in line with its dividend index over the past two decades. This concurs with the discounted dividend model for pricing stocks, where (apart from changes in the discount factor representing the cost of capital) changes in equity prices are explained by changes in future dividends, provided the discount factor remains stable.

Naturally, the difference between the total return index and price index reflects dividends and the reinvestment of dividends. The valuation adjustment describing changes in equity prices not explained by dividends is negative but fairly small over a 20-year horizon. In essence, this means that over the past two decades dividends and dividend growth have been driving total equity returns. In addition, we observe that only about a third of the notional growth of dividends over the past two decades was explained by inflation, the remaining part representing the real growth of dividends.

Exhibit 156: Dividends growth model for MSCI ACWI



Source: MSCI, OECD. Data from Dec. 30, 1994 to Feb. 28, 2019. Inflation data is based on USA inflation (CPI) levels.

Exhibit 157 and Exhibit 158 extend this analysis to the four regions.

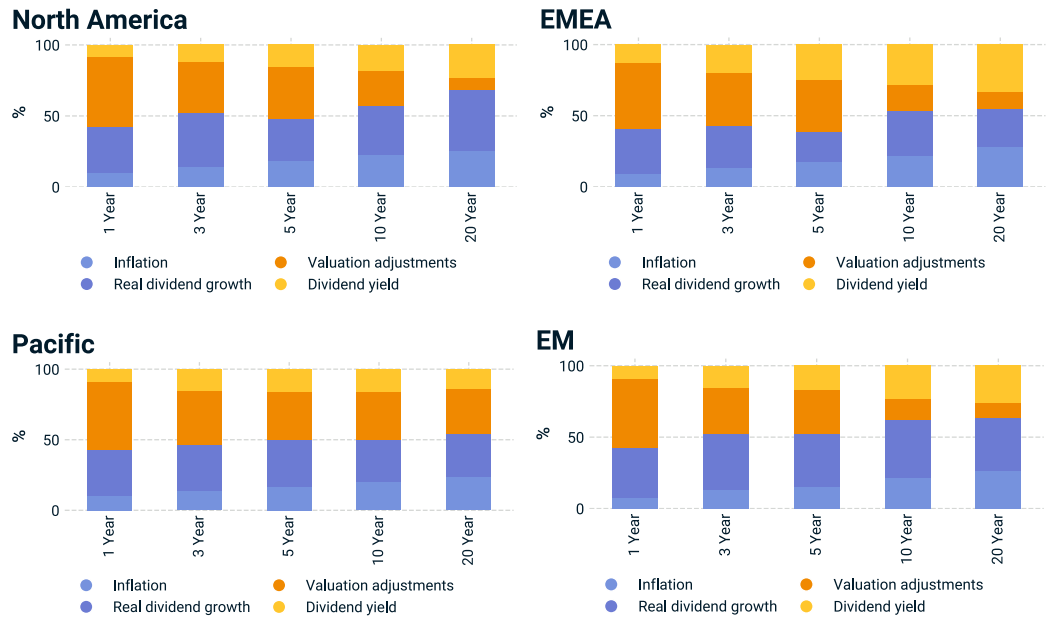
Exhibit 157: Dividends growth model decomposition of returns

Region	Total return	Dividend yield	Real dividend growth	Inflation	Valuation adjustment
ACWI	6.37	2.02	2.89	2.22	-0.76
North America	7.69	2.01	3.73	2.22	-0.27
EMEA	6.14	2.68	2.09	2.23	-0.87
Pacific	3.38	1.29	2.81	2.2	-2.92
EM	6.82	2.19	2.86	2.22	-0.47

Source: MSCI, OECD. Data from Dec. 30, 1994 to Feb. 28, 2019. Inflation data is based on USA inflation (CPI) levels. Total returns shown are averages of rolling 20-year returns.

Broadly speaking, dividends and dividend growth explain the majority of total equity returns in each region. However, there are also clear regional differences: In North America and Emerging Markets equity prices have risen almost exactly in line with dividend growth, as the valuation adjustment in these markets was fairly small. In EMEA, equity prices have remained slightly behind the regional growth in dividends, which was below the global dividend growth level. As a consequence, about half of the growth in dividends in EMEA has been due to price inflation over the past two decades.

Exhibit 158: Dividends growth model for four global regions



Source: MSCI, OECD. Data from Dec. 30, 1994 to Feb. 28, 2019. Inflation data is based on USA inflation (CPI) levels.

The most notable exception to the global pattern is the Pacific region, where equity prices have clearly lagged behind the regional growth in dividends, resulting in a much larger negative valuation adjustment than in any other region. In economic terms, this means that Pacific is the only region where dividends and dividend growth alone are not sufficient to explain total historical equity returns over the past two decades.

Exhibit 62 shows the missing component: In the Pacific region valuation levels have seen the largest decline over the past two decades to the lowest level in any region, resulting in equity prices not keeping up with dividend growth. As a result, dividend yields here have shown the strongest increase over the past two decades. This pattern is mainly explained by the sluggish equity market in Japan, which is by far the largest country weight in the region and where valuation levels are relatively low compared to the rest of the world. To be precise, as of 31 Dec., 2018 the price-to-book ratio of MSCI Japan was 1.2, compared to 1.7 in MSCI Pacific ex Japan, 2.0 in MSCI ACWI and 2.5 in MSCI North America.

Equal risk contribution indexes

Following Maillard et al. (2018) Equal Risk Contribution portfolios (ERC) are based on a weighting scheme that ensures that the marginal contribution to portfolio volatility is the same for all constituents. In this research report we focused on building equal risk contribution portfolios at a regional level instead of at a security level because of the large number of securities in the global benchmark, which can lead to large uncontrolled shifts in security and country weights. Therefore, in the following each region is represented by its regional benchmark.

With the vector of regional portfolio investments w and the covariance matrix C , the portfolio volatility reads

$$\sigma_P = \sqrt{w^T C w}$$

The marginal risk contribution of asset j to the total portfolio risk reads

$$\frac{\partial \sigma_P}{\partial w_j} = \frac{(Cw)_j}{\sigma_P}$$

Therefore, the ERC portfolio is (approximately) identical to an equal weighted portfolio when the row averages of the covariance matrix are (approximately) identical.

Equal weighting has the advantage of being a very transparent and robust methodology, which avoids weight fluctuations caused by term fluctuations in the covariance matrix.

To assess whether we can approximate a regional ERC portfolio by a regionally equal weighted portfolio, we look at the variation of the row averages of the regional covariance matrix (Exhibit 31). Over the past two decades, the row averages have been between 0.785 and 0.8325, with a small standard deviation of only 2.2%, which means that the covariance matrix is relatively uniform. Therefore, we can use regional equal weighting as a proxy for regional ERC weighting in this report.

Country equity risk premium

According to Fernandez et al. (2016) country equity risk premia can either be measured using the historical equity risk premium

HEP = Historical equity performance - treasury yield

Or in a fundamental way, i.e., using the required rate of return implied by observed equity prices over treasury yields. Within a discounted dividend model, the implied equity risk premium (IEP) reads:

$$IEP = \text{Dividend yield} + \text{dividend growth rate} - \text{treasury yield}$$

Country risk premia are influenced by market characteristics such as size, liquidity and openness of the market (Donadelli et al., 2012).

To assess the influence of market characteristics and country risks on the country equity risk premium, we perform a regression analysis over countries $c \in \{\text{Countries in ACWI}\}$ and years $t \in [1998, 2018]$:

$$EP_{c,t} = \text{Regression}_{c,t}(EP_{ACWI,t}, \log(\text{market size}), \text{market liquidity}, \text{country risk})$$

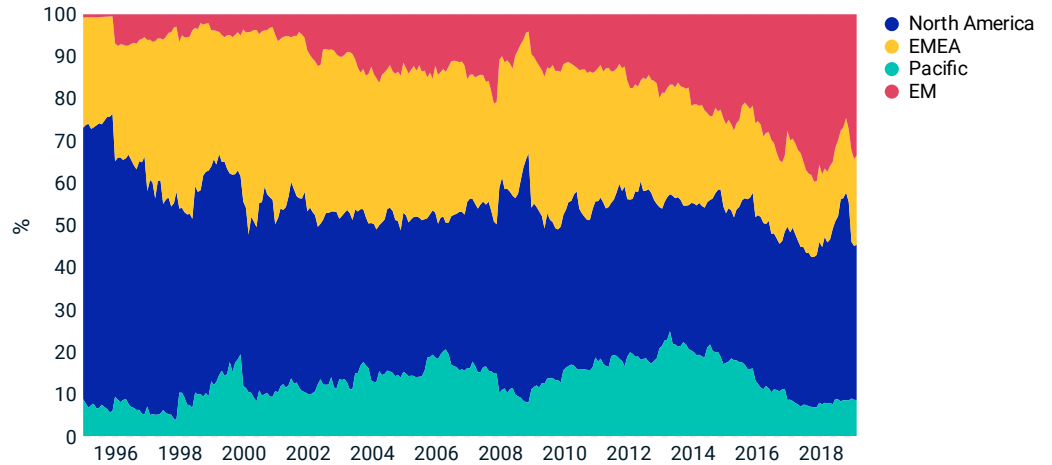
We use MSCI country indexes as benchmarks for each country, using the index market cap and index liquidity as proxies for market size/openness and market liquidity in the regression analysis. $EP_{ACWI,t}$ denotes the global equity risk premium at time t . Country risks are measured using MSCI ESG country scores / World Bank Governance scores.

The betas of the regression show how far country equity risk premia are driven by country specific market characteristics and country risk.

Customized weighting schemes

To illustrate how two weighting approaches may be efficiently combined, Exhibit 159 shows a weighting scheme that brings GDP weighting together with the aforementioned risk weighting approach, by multiplying the corresponding regional weights of both approaches and normalizing the weights to sum up to 100%.

Exhibit 159: Regional weights using GDP and risk weighting in parallel



Source: MSCI. Data from Dec. 30, 1994 to Feb. 28, 2019.

This approach is a slightly nuanced version of GDP weighting, as it shows slightly less exposure to Emerging Markets, adjusting for their higher volatility.

Mandate by the Norwegian Ministry of Finance

January 2019

MANDATE ON SELECTED GEOGRAPHICAL ISSUES IN THE GLOBAL LISTED EQUITY MARKET

1. The Management of the Government Pension Fund Global

The Ministry of Finance is responsible for the management of the Government Pension Fund Global (GPFG). The Ministry determines the investment strategy for the Fund through rules and general principles, including a strategic benchmark index and an overall risk limit for the total portfolio of 1.25 percent tracking error. The operational management of the Fund is carried out by the Norges Bank.

The investment strategy for the GPFG aims to achieve the highest possible return within an acceptable level of risk. Within this scope, the Fund shall also be a responsible investor. Broad diversification of investments across markets, sectors and companies is a key premise in the investment strategy. Moreover, the investment strategy aims to exploit the Fund's distinct characteristics, including its large size, very long investment horizon, transparency and relatively small liquidity needs in the short run.

More information about the Fund is available on www.government.no/gpf.

2. Current geographical allocation of the Fund

The Fund's strategic benchmark index for equities investments is based on the FTSE Russel Global All Cap index. The benchmark includes all markets that the index provider classifies as developed markets, advanced emerging markets, and secondary emerging markets, with the exception of Norway.

The FTSE Russell All Cap Index is based on global market weights, but adjusted for free float. The free-float adjustment of the Fund's current equity benchmark reduces the market value of the index by about 20 percent compared to full market capitalization. The adjustment also has an impact on the geographical distribution of the composition of the benchmark. Different ownership structures in different

markets imply that the free-float adjusted benchmark has a lower percentage of North American stocks and a higher percentage of European stocks than the full market value of the companies in these regions would suggest. Furthermore, a substantial part of the shares in listed companies in emerging markets are not available for the broad market. These markets therefore receive a lower weight in a market weighted index adjusted for free float, compared to an index based on full market capitalization. The adjustment makes the benchmark more liquid and facilitates low transaction costs. On the other hand, it leads to more frequent changes in the composition of the indices.

The benchmark index for equity investments is supplemented by regional adjustment factors⁽¹⁾. The table below shows that the effect of the adjustment factors on the regional distribution essentially is an overweight of Europe and an underweight of North-America.

Until 2012, the benchmark index for equity investments was divided into three geographical regions: Europe, America/Africa and Asia/Oceania with fixed weights. In the white paper to Parliament in 2012 (Meld. St. 17 (2011-2012)), the Ministry proposed to change the benchmark for equity so that the geographical distribution to a greater degree would track global market weights. However, the Ministry identified some considerations which indicated that the transition should not go all the way to full market weights:

- A switch to global market weighting would have meant that the proportion invested in Europe would have dropped by approximately half. This would have been a major change. The Ministry also pointed out that there might be reasons for the Fund to continue to invest a proportion in Europe in the long-term that is somewhat higher than suggested by market weights.
- A switch to global market weighting would have entailed a very high portion invested in the North-America. Although the world's companies and financial markets have become increasingly international, the Ministry pointed out that country-specific risk should be taken into account in the geographical distribution of the Fund's benchmark.

The Ministry pointed out that the goal of avoiding an excessive portion in the North-America and the goal of avoiding an excessively sharp reduction in the European portion could be seen in conjunction. Rather than switching to global market weights entirely for both Europe and the North-America, the Ministry instead proposed a more even distribution between these markets than the prevailing regional weights. This led to the current regional adjustment factors in which Europe was given a weight, which is lower than the previous regional weight, but somewhat higher than

indicated by market weights. North-America was given a higher weight, which is nevertheless lower than market weights.

One reason for the European weight has been a consideration regarding the Fund’s exchange rate risk. As Norway imports most from Europe, it has been natural to think that it can protect the purchasing power of the Fund against exchange rate risk by investing most in European markets. In Report No. 15 (2010–2011) to the Storting – The Management of the Government Pension Fund in 2010, the Ministry undertook a new assessment of the Fund’s exchange rate risk. It concluded that the exchange rate risk

(1) The adjustment factors are applied as follows. The weight of a stock in the benchmark index is adjusted by a factor, whose size depends on the region in which the stock is listed. The factors in the four regions are: 2.5 (Developed Europe-ex-Norway), 1.0 (USA and Canada), 1.5 (other developed markets) and 1.5 (emerging markets, i.e. FTSE Russell advanced and secondary). The formula is described in detail in section 3-3 in the management mandate for the Government Pension Fund Global.

appeared to be smaller than previously assumed, and there was no longer a basis for such a strong concentration of the investments in Europe.

Stock index weights at the end of 2017 with and without adjustment factors

Regions	Index weight without factor	Index weight with factor	Difference (percent)
Developed markets	91.8	91.5	-0.3
North-America	55.3	38.4	-16.9
Europe	21.7	37.7	16.0
Middle East and Africa	0.3	0.3	0.0
Asia-Oceania	14.5	15.1	0.6
Emerging markets	8.2	8.5	0.3
Sum	100.0	100.0	0.0

Sources: Norges Bank and the Ministry of Finance

3. Analysis of the geographical distribution of equities

The Ministry is currently carrying out a review of the equity benchmark of the GPF. As part of this review the Ministry is commissioning a report on analysis of the geographical distribution of equities.

The geographical distribution of the equity benchmark should substantiate key aspects of the Fund's investment strategy: risk reduction through broad diversification of investments, and high expected returns within acceptable limits of risk. This should be achieved by harvesting well established risk premia that are well suited for the Fund. The long investment horizon of the Fund implies that risk and return analyses should go beyond the short term, and assess the benefits of diversification in the long run.

3.1 Update on the global equity markets

The report should provide an update on important developments in the composition of the global equity markets, including the expansion of the global investment opportunity set. Furthermore, the report should describe major trends in globalization which might impact diversification opportunities for long term investors, such as the increasing role of emerging markets, internationalization of companies' sales and value chains and degree of "home bias" among global investors.

3.2 Construction of the global free-float adjusted markets index

The report should describe the MSCI's index rules and assess their impact on regional allocation. Developments and rules that may impact the geographical composition of the MSCI global equity index going forward, such as inclusion of new markets and changes in country classifications should be discussed. The report should also describe historical incidents of capital controls or other changes that has led to market reclassifications.

3.3 Composition and characteristics of regional and emerging markets

The report should describe the composition and risk/return characteristics of developed regions (North America, Europe, Asia/Pacific) and emerging markets. Special characteristics of emerging markets in general and in terms of political and

ESG-related risks, should be discussed. Potential risk premia in emerging markets and the relationship between economic growth and equity returns should be assessed, including an overview of relevant academic research.

The report should assess alternative global equity benchmarks rules for emerging markets, and their characteristics in terms of risk and returns and exposure to political risk and ESG-related risks.

3.4 Geographical allocation – implications for risk and return with alternative weighting schemes

The report should compare alternative weighting schemes for regional allocation (i), including the current weighting scheme of GPFG. Alternative weighting schemes should cover full and free float adjusted market weights, weighting schemes based on allocation of risk between regions and weighting schemes based on the regional distribution of economic variables such as GDP or listed companies fundamentals. Differences in terms of geographical allocation, risk and return characteristics should be compared and analysed. The insight that alternative weighting schemes provide for the geographical allocation should be discussed.

3.5 Other dimensions of risk and returns

The report should discuss other dimensions of risk and returns, in particular the impact of industry composition, company specific risks and the characteristics of small caps.

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